Division of Agricultural Sciences

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CALIFORNIA DAIRY FARM *MANAGEMENT*

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CALIFORNIA DAIRY

A dairy farm in California is an intensive enterprise, existing on high-priced land, with high capital investment, and high operating costs unless good management practices are applied consistently.

This circular describes good management practices in all the phases of dairy farming that determine profit. It summarizes the latest findings of research and the experiences of many successful dairies throughout the state. Its information will be of value to the established dairyman as well as to the man who intends to go into dairy farming.

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FARM MANAGEMENT

DAIRYING AS A BUSINESS

DAIRYING, in value of its products, is one of the most important single agricultural enterprises in California. In 1959, milk was the major source of income for about 8,045 farms. The California Crop and Livestock Reporting Service estimated that during 1961 an average of 813,000 cows were milked, producing 8,236 million pounds of milk. Cash receipts from farm marketings of dairy products were $391,048,000, or 12 per cent of the total cash receipts from farm marketings (see table on page 4). In addition, dairymen, in maintaining their herds, produced and sold a substantial number of cattle and calves for beef and veal.

MARKET AND MANUFACTURING MILK

Milk in California is produced as either market (or Grade-A) milk or manufacturing milk.

Market milk

All milk sold as fluid milk and cream must be produced as market milk, that is, under strict sanitary requirements of state and city laws and regulations. Market milk can also be sold for the manufacture of milk products. According to its uses, market milk is classified into

Class I—milk sold as fluid milk, cream, and related fluid products;

Class II—milk used in products not otherwise defined as Class I or III, principally cottage cheese and ice cream;

Class III—milk used for the manufacture of butter, cheese, and nonfat dry milk.

In 1961, 75 per cent of the market milk produced in California was used as Class I; of the remaining 25 per cent, most was used in the manufacture of cottage cheese, ice cream, and frozen desserts. During certain parts of the year, a large quantity was also used for butter and nonfat dry milk.

Market milk, generally, brings a higher price than manufacturing milk, but requires better buildings and more equipment for cooling and handling. A dairy so equipped, and selling the major part of its milk for this purpose, is called a market-milk or Grade-A dairy.

Minimum prices to producers are determined for each class of market milk by the Bureau of Milk Stabilization of the State Department of Agriculture. Market milk is sold to distributors under a contract specifying the quantity of milk to be paid for at Class-I prices. The contract specifications, and thus the average price received, vary widely for individual dairymen. Minimum prices currently in effect are reported in the "Dairy Information Bulletin" published by the California Crop and Livestock Reporting Service.

The most remarkable change in California milk production during the past 25 years has been the shift from the production of manufacturing milk toward market milk with its stricter production requirements and higher prices. This and the increased milk production per cow account for the steadily rising cash income.

THE OVER-ALL DAIRYING PICTURE IN CALIFORNIA

Period or year	Cows milked, average for year	Average production per cow		Commercial milkfat production			Market milk	Average price per hundredweight		Cash farm income from milk, excluding subsidies
		Milk	Fat	Total	Market milk	Manufacturing milk		Market milk	Manufacturing milk	
	Thousands	*Pounds*		*Million pounds*			*Per cent*	*Dollars*		*Thousand dollars*
Prewar, 1937–1941	687	6,796	260	166.4	74.8	91.6	45	2.30	1.64	92,615
War years, 1942–1945	772	7,000	270	191.2	105.3	85.9	55	3.90	3.38	175,558
Postwar, 1946–1950	798	7,390	288	216.6	136.5	80.1	63	4.71	3.64	254,283
1951	781	7,700	300	221.5	149.5	72.0	67	5.00	3.97	279,866
1952	793	7,660	289	222.0	153.0	69.0	69	5.64	4.41	320,589
1953	816	8,100	308	240.6	164.9	75.7	68	5.29	3.82	326,501
1954	834	8,400	319	255.1	171.6	83.5	67	4.62	3.18	300,804
1955	840	8,620	328	262.8	179.4	83.4	68	4.61	3.20	312,799
1956	844	8,700	331	264.8	191.2	73.6	72	4.74	3.30	331,203
1957	850	9,060	340	277.2	210.7	66.5	76	4.75	3.37	355,507
1958	836	9,110	342	273.1	215.7	57.4	79	4.68	3.21	350,071
1959	830	9,570	354	283.6	229.5	54.1	81	4.74	3.28	375,279
1960	824	9,800	363	289.2	230.1	59.1	80	4.77	3.20	382,200
1961	813	10,130	375	294.9	236.5	58.4	80	4.71	3.33	391,048

Source: Calif. Crop and Livestock Rep. Serv., Calif. Dairy Stat. for 1961, July 1962, pages 9, 14, 30.

Manufacturing milk

All milk other than market milk is called manufacturing milk. In California, most of it is sold as whole milk for the manufacture of evaporated milk, dried milk, cheese, and butter. A small amount (slightly more than 1 per cent of the total manufacturing-milk fat) is sold as farm-separated churning cream.

Manufacturing-milk production has been declining both in absolute and relative terms. During the prewar years, manufacturing-milk-fat production was 92 million pounds, or 55 per cent of the total; in 1961 it had dropped to 58 million pounds, or 20 per cent of the total (see table on page 4).

Despite this decline, several important manufacturing-milk production areas remain in California, particularly in Stanislaus, San Joaquin, and Merced counties in the San Joaquin Valley, and Humboldt County in the North Coast area.

It is important to note that despite the decrease in manufacturing milk production, more milk is currently used for manufacturing purposes than during any previous year. The reason for this is that an increasing amount of market milk is being produced and a larger part is being used for the manufacture of dairy products.

SPECIALIZED DAIRY FARMS

In California, both types of milk are commercially produced mostly on specialized dairy farms. The average herd size is larger here than in any other important dairy state—94 milk cows per farm, according to the 1959 census. The same census indicates an average of 218 cows per farm in southern California, 80 cows per farm in the San Joaquin Valley, and 50 cows per farm in the Sacramento Valley.

Many of the market-milk dairies located near metropolitan centers are corral- or drylot-type dairies where no feed is produced and few, if any, calves are raised. This type of drylot operation has long dominated the southern California area, and is increasing in the southern San Joaquin Valley area. In areas where manufacturing-milk production is still important, most of the dairy farms grow a substantial part of their own forage in the form of pasture, hay or silage.

Although dairy farms in California are highly specialized, there are many different types because of their wide distribution over areas of different climates, kinds of feed, and cost levels.

PRODUCTION EFFICIENCY

California dairies have the highest production efficiency for any state in the country. Average production per cow in 1961 was 10,130 pounds of milk and 375 pounds of milk fat as compared with the national average of 7,211 pounds of milk and 270 pounds of milk fat.

California consistently has had the largest number of cows on production test—329,517 cows in January, 1962. This is approximately 40 per cent of the total number of milk cows in the state. Average production for the California cows on test in 1961 was 12,311 pounds of milk and 474 pounds of fat per cow, compared with 10,796 pounds of milk and 418 pounds of fat for all cows on test in the entire country in 1960. High production per cow may be attributed in part to climate and the abundance of high-quality dairy feeds, but most likely to good management and the specialized types of operation predominant in California.

THE PRESENT SITUATION

California is a deficit area for total dairy products: more are shipped in than are shipped out. The state produces more market milk than it needs for fluid milk and cream; however, it does not produce enough milk for all of the manufactured dairy products consumed by its population. A large proportion of the total butter and cheese requirements is shipped in from other states. California is also

deficient in the production of cows necessary to maintain its milking herds and in the quantity of feed necessary to feed all of its cattle and other livestock. In 1960, about 27,000 dairy cows were shipped in from other states. During the years 1954–57, an estimated annual average of more than one million tons of feed grain was shipped into California.

Although California's population and the consumers' buying power have both been increasing, the total consumption of Class-I products has increased only slightly during the last three years. On a per-capita basis, the sales of fluid milk have been decreasing ever since 1956. Production of market milk has risen faster than the demand for fluid milk. But the total quantity of commercial milk produced is not now, and is not expected to be in the future, adequate to supply the total needs of the California population for all dairy products.

THE FUTURE

Market-milk production in California will probably continue to increase adequately to meet the fluid-milk needs of our growing population. This presumes that producer prices, as set by the state, will be at levels adequate to keep enough Grade-A dairymen in business to assure an adequate supply of fluid milk. While producers who practice good management will obtain a fair profit, prices and earnings probably will not be high enough to enable dairying to compete with high-value field, vegetable, and fruit crops on some of our better irrigated lands. Dairying will tend to become more specialized with more and more operations moving in the direction of drylot dairying.

Manufacturing-milk production will continue to decline, with individual producers shifting to market-milk production and alternative enterprises. Although some market milk will be used to produce manufactured dairy products, California will continue to be a deficit state in terms of total requirements. Government activities will continue to influence the price paid producers for all grades of milk. Present minimum prices paid to producers of market milk, and federal price support of manufacturing milk by government purchase of butter, cheese, and nonfat dry milk, will also in the future be among the government activities and programs that will influence the California dairy industry.

ADJUSTING TO CHANGES

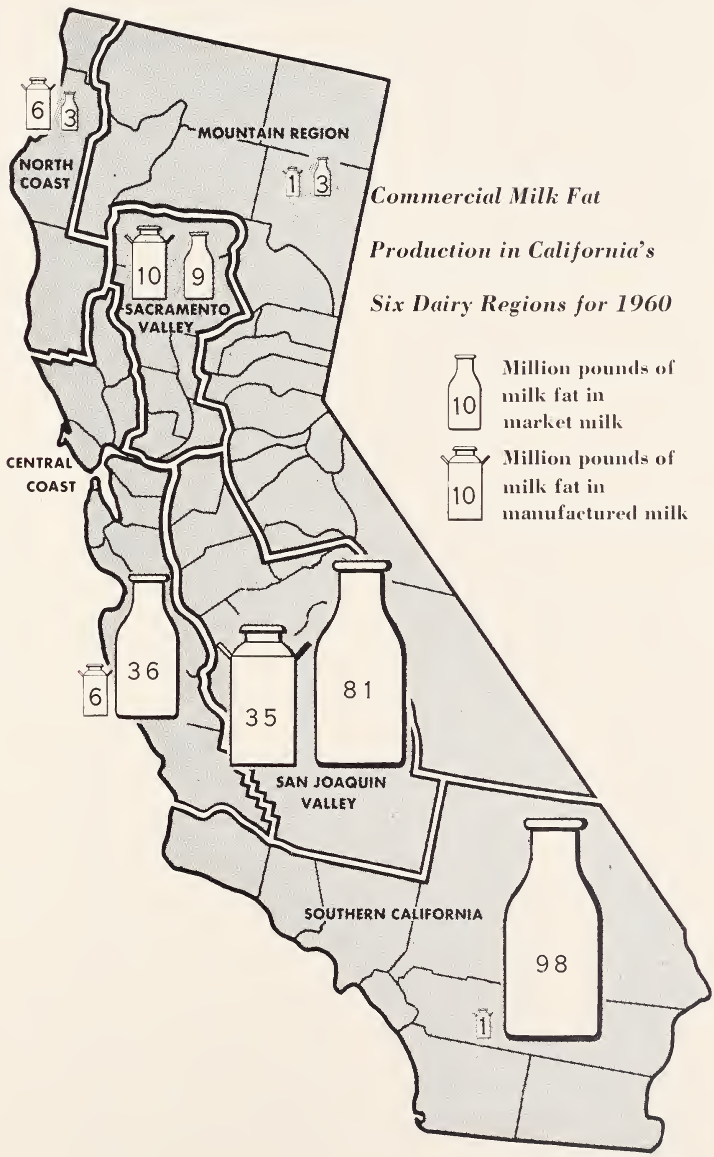
Milk and feed prices change from time to time. As a dairyman, you should watch the short-run outlook for opportunities to improve profits; however, once in business you cannot profitably shift in and out with short-run price changes. But you can improve your chances of success and security by basing your current decisions on the best of information. Economic outlook information on current trends in prices is available from federal, state, and other sources. Your local dairy Farm Advisor has this information and can advise you in its application. The price received for milk used as Class I is substantially higher than that for milk produced and used for other purposes. Within the terms of your contract with your distributor, you are able to adjust your herd size and production per cow to obtain the largest possible profit. For some producers in certain areas, this will mean a total quantity of milk slightly higher than the contract specifications. For other producers, the highest profit level of production might lie well in excess of contracted levels. You will have to investigate your own situation and adjust accordingly.

When the prices of beef and feeds are high in relation to milk prices, it will be profitable to sell your cull and surplus cows and adjust your herd size to a more economical level. When feed prices are low and milk prices good, it may pay to increase the size of business and buy extra feed as needed. When the outlook for profit is poor, it is important to economize on expenditures and keep the budget

balanced to remain financially strong. Constant attention to management is a dairyman's safeguard in bad times and his assurance of higher profit in good times.

CALIFORNIA'S SIX DAIRY REGIONS

CALIFORNIA'S six major dairy regions and their commercial milk-fat production are shown in the map below. The number of dairy farms, cows, and the amount of production by region are given in the table on page 8.



Commercial Milk Fat Production in California's Six Dairy Regions for 1960

California's six dairy regions show great variations as indicated by the figures in the left part of the table. The right part indicates trends during the recent 1955–60 period.

DAIRYING IN CALIFORNIA, BY REGIONS

Region	Dairy farms		Cows milked*	Dairy cows and heifers, 2 yrs. and older	Dairy products	Milk fat production		Total milk fat			Market milk	
						Market milk	Mfg. milk	1955	1960	Change	1955	1960
	Number*	Per cent of all farms*	Number		Per cent of all products sold*	Thousand pounds		Thousand pounds		Per cent	Per cent of total milk production	
North Coast	513	19	25,054	29,900	36	2,880	5,877	9,355	8,757	− 6	22	33
Central Coast	1,031	6	111,537	141,300	12	36,157	5,920	39,098	42,077	+ 8	83	86
Southern California	1,029	4	223,968	265,400	16	98,236	1,473	82,873	99,709	+20	99	99
Sacramento Valley	1,226	10	60,821	72,500	6	8,995	9,854	19,679	18,849	− 4	36	48
San Joaquin Valley	3,991	12	317,506	372,200	10	81,361	35,068	107,951	116,429	+ 8	50	70
Mountain and Northeast	255	4	14,646	17,700	6	2,504	859	3,802	3,363	−12	54	74
California total	8,045	8	753,532	899,000	11	230,133	59,051	262,758	289,184	+10	68	80

SOURCES: Columns marked * are based on data from the U. S. Bureau of the Census, Census of Agriculture, 1959. All other columns on data from Calif. Crop and Livestock Rep. Serv., Calif. Ann. Livestock Rep., Summary for 1960. June 1961, page 7, and Calif. Dairy Ind. Statistics for 1960. July 1961, pages 28–30.

NORTH COAST

Dairying here is largely the production of manufacturing milk from the hay, pasture, and silage in coastal valleys and along the coastal bench. Rainfall is higher than in any other part of the state, beginning earlier in the fall and extending later into the spring, so that natural pasture and hay meadows are very productive. Winters, although mild, are so wet or cold that many fields cannot be pastured. It is usual, therefore, to freshen most of the cows in the spring, making it a highly seasonal production. The practice of irrigating, now increasing, prolongs the green-feed season through late summer and early fall. Most of the hay used and some silage are produced in this area, although some additional hay is brought in from the outside.

Between 1955 and 1960, milk production declined in the North Coast region by 6 per cent. There was a continuing shift from manufacturing to market milk, which increased from 22 to 33 per cent of the total. Most of this shift took place in Mendocino County, where in 1960 market milk accounted for 84 per cent of total production. Market-milk production increased slightly in Humboldt County, but a further increase is not expected because of the limited local outlets open to local producers and a lack of outside marketing opportunities.

CENTRAL COAST

This long region extends from Sonoma and Lake counties on the north to San Luis Obispo on the south. It includes 13 counties, seven of which are on the coast. Hence this area has a range of climatic conditions from coastal to interior and a wide range in annual rainfall. It contains several irrigated valleys such as Santa Clara and Salinas. Some of the dairy farms in this region are similar to those in the San Joaquin Valley, with irrigated forage crops; others are nonirrigated farms with dry-farmed forage crops and natural pasture.

This is an old and well-developed dairy region, with a considerable shift in recent decades from manufacturing to market milk. Eighty-six per cent of total production is now market milk, largely for the San Francisco Bay metropolitan area. Dairying is being crowded out by urbanization in some metropolitan fringe areas and also by high-value crop production in the Santa Clara and Salinas valleys. Dairy farms and number of cows continue to decline in the area as a whole, but total milk production has increased by 8 per cent in the last five years. The two leading Central Coast counties in milk production are Marin and Sonoma just north of the Bay, where production increased 15 per cent in the last five years. Herds have increased in size and have become more dependent on alfalfa hay produced in the interior valleys.

SOUTHERN CALIFORNIA

This large region of eight counties and several climatic subregions contains 58 per cent of California's total population. Hence dairying here is almost entirely market milk for this large and growing population, but production is only 43 per cent of the state total, so additional milk is shipped in from the San Joaquin Valley. Despite the declining land area available for dairying and forage production near Los Angeles, total milk production is increasing in the region as a whole faster than in any other region of the state, with a 20 per cent increase in the last five years and a 33 per cent increase in the previous five years. Total dairy farms were about the same in number for the region in 1959 as in 1954, but the number of cows has increased about 14 per cent. Production per cow is higher than in any other region. Forage requirements are met mostly by hay transported from areas of alfalfa production.

In the entire southern California coastal area from Santa Barbara to San Diego counties, farm land with irrigation water is limited and declining because of

the growth of cities and suburban residential and industrial areas. Land values are high because of urbanization, high-value fruit and vegetable crops, and other competing uses. Dairying that remains in Los Angeles and Orange counties is now largely concentrated in areas zoned for this purpose. These are entirely drylot or corral dairies, where a large number of cows are fed hay in corrals where they are held between milkings. Replacement cows are purchased from other regions and other states, or heifers are transported elsewhere to be raised and returned later. This great development of milk factories in an urban fringe area continues to be profitable because of its good local market and high percentage of milk paid for at Class-I prices. Services to dairymen in labor, feed, replacement cows, equipment and credit are highly developed and competitive and, in part, contribute to the high level of efficiency attained.

In the last five years milk production declined slightly in Los Angeles County, with the movement of some dairies further out from the city of Los Angeles into western Riverside and San Bernardino counties, where the greatest increases took place. All the other counties had small increases, except Imperial County.

Hay for this great concentration of 30 per cent of the state's dairy cows comes largely from the irrigated farming areas across mountains; from the Imperial Valley, the Palo Verde Valley in eastern Riverside County, the Antelope Valley in northeastern Los Angeles County, and the San Joaquin Valley.

SACRAMENTO VALLEY

Market-milk production increased slightly in all of the nine Sacramento Valley counties over the past five years, but manufacturing-milk production dropped, so that the region experienced an over-all decrease of 4 per cent in total milk production. The Sacramento Valley has an adequate supply of irrigation water and some land yet to be developed and irrigated. Some of this land is shallow and better adapted to irrigated pasture and dairying than to higher-value field and truck crops. Hence this is an area where dairying would be expected to increase. Manufacturing milk production was 64 per cent of the total in 1950 and increased 17 per cent in the five years to 1955, but during the next five years declined 21 per cent, and is now lower than it was 10 years ago. This indicates that production of manufacturing milk was not as profitable as other alternatives. The number of dairy farms, as shown by the U. S. Census of Agriculture, declined from 1,973 in 1954 to 1,226 in 1959.

SAN JOAQUIN VALLEY

The San Joaquin Valley is the most important dairy region in the state; it contains 41 per cent of the cows and produces 40 per cent of the total milk fat. From 1955 to 1960, market-milk production increased 51 per cent and manufacturing milk production declined 36 per cent, with the result that total production increased by 8 per cent. Market-milk production increased from 50 to 70 per cent. The San Joaquin Valley is an area with a large surplus of market milk and great variations in producer contracts, resulting from many recent shifts from manufacturing to market milk production. Census classification shows a decline in dairy farms from 6,855 in 1954 to 3,991 in 1959. Both census and crop-reporting-service figures show a decline in number of cows. These facts along with observed rapid increases in herd size and a substantial increase in total production and an even greater increase in production per cow, indicate adjustments that are taking place in the battle for survival.

Market-milk production here is not only for local centers of population such as Fresno, but also for large shipments to the Los Angeles and San Francisco areas. Although there is currently a considerable surplus of market milk seeking an outlet,

it is probable that additional shifting from manufacturing-milk production will take place in the future as opportunities occur.

Dairying in this region is well adapted to the many irrigated farms which can produce excellent yields of alfalfa, silage and pasturage. Most of the forage needed can be produced on the dairy farms. The San Joaquin Valley is also a large surplus alfalfa-hay producing region, with local prices of excellent baled hay about $6 a ton below the price of the same hay at Petaluma and Los Angeles. This commercial hay is produced on field and vegetable farms by large-scale machinery and methods, and is available to local dairymen at reasonable prices. Dairymen in this area usually raise their own replacement heifers, and some farmers raise dairy heifers for sale or on a custom basis for others.

The San Joaquin Valley is also the greatest farming region of the state with a large variety of high-value field crops, vegetables, and fruits that are well adapted to the many smaller areas where they are most successfully grown. Most of these crops are more profitable than forage crops, so land values and rents are more than dairymen can afford. Although some of these competing crops also have their surplus and price problems, they still continue to displace some dairying. There are, however, many areas of less desirable lands where dairying can continue and to which it can move if crowded out elsewhere. There is also a considerable shift to corral dairying on hay purchased from nearby field-crop farmers. Most of the small number of dairies remaining in Kern County are of this type. There has been a large increase in the feeding of beef cattle in this region in the last 15 years. Dairying, with its higher returns to labor and management, can compete favorably with this business. So, although dairying has its problems in the San Joaquin Valley, it will continue and probably increase as more of its milk can be sold for Class-I uses. Manufacturing-milk production, formerly the main type and still important in the northern counties, will continue to decline here as more profitable alternatives become available and producers go out of business because of low earnings.

MOUNTAIN AND NORTHEASTERN REGION

This large area is mostly mountainous and not adapted to farming. Beef cattle dominate in the use of the forage harvested in the valleys and the seasonal grazing in the desert and mountains. There are a few small dairies producing market milk for local use throughout the area. Market-milk production increased 23 per cent in this varied region of 17 counties from 1955 to 1960 when it was 74 per cent of the total. A shift from dairying or going out of business by manufacturing-milk producers is also shown in this area by a decline of 158 dairy farms and 51 per cent decline in manufacturing-milk production. Most of the creameries making butter from churning cream in mountain valleys 20 years or more ago, are now gone. No significant change in current trends is expected for the future.

THE DAIRY-FARM BUSINESS

Management of the dairy-farm business, or its analysis and planning, is best approached through the separate enterprises of which it is composed. An enterprise is a single crop or kind of livestock grown to produce a profit. The total dairy farm business is composed of one or more of the following enterprises:

- The milking herd.
- The raising of heifers for replacement and other dairy stock for sale.
- The production of forage for feeding the dairy stock:

  Alfalfa for hay or green chopped forage and some pasture.

  Silage such as corn, sorghum, or oats and vetch.

  Irrigated pasture.

  Natural or nonirrigated pasture or range.
- Sometimes, a crop produced for sale—sugar beets, cotton, vegetables, etc.

Total dairy-farm businesses are seldom comparable with one another because the proportions of the above enterprises vary. Hence, no standard, or typical budget, or statement of income and costs can be presented for the total farm business for which the major source of income is from milk and dairy cattle—classified as dairy farms.

The corral dairy, where all feed and replacements are purchased, is composed of a single enterprise—the milking herd. This is the prevalent type of dairy farm in southern California and is increasing in the San Joaquin Valley and the metropolitan fringes.

Some corral dairies raise their own replacements partly in their own corrals and partly by placing their calves out on rented pasture or on other farms where care and feeding is paid for. Such dairy farms may then be considered as having two enterprises—the milking herd and raising of replacements.

Most dairy farms in the United States produce much of the forage used by the milking herd and stock raising enterprises and sometimes part of the grain. In California, many dairy farmers started out with a dairy herd, cows and young stock, small enough to use the forage production of the farm in hay, silage, and pasture. To increase net income, they increased the number of cows to the point where much of the forage had to be purchased off the farm, largely as baled alfalfa hay. But purchased hay costs more than the farm value of hay grown right on the farm. And pasture, often the cheapest form of nutrients, is obtainable only on the farm where produced.

On many California farms highest profit is still available from dairying where the milking herd is fed from low-cost forage grown in feed-crop enterprises in the same farm business.

Feed production on dairy farms may take place in one or several enterprises, depending on location and competing cash crops. For this reason there is in some areas, such as southern California, little forage production on dairy farms. Land values and taxes are high, and purchased hay can be trucked in from lower-cost areas for less than it can be grown locally. Crop production, in such areas of high land values, taxes, and irrigation-

The Dairy Enterprise—a changing concept

The dairy enterprise has long been considered as a separate part of the dairy-farm business in California. Dairy management or cost studies were conducted and published from 1925 to 1955, occasional surveys have been made, and sample schedules of inputs and costs have been issued. In the past, most of these schedules have been for the total dairy enterprise as composed of the milking herd plus the raising of replacements. In recent years, however, the number of single-enterprise corral dairies has been increasing, and a growing number of dairy farmers have been figuring their costs on the milking herd separately from the heifer raising.

water costs, is limited to high-value crops such as fruits, vegetables, and other horticultural specialties; hence, the prevalence of corral dairies which buy all their feed. In parts of the San Joaquin Valley and in metropolitan fringes the competition for land favors buying hay rather than producing it on local dairy farms.

In some parts of California, a profitable type of farming is still dairying with most of the forage for the dairy herd produced in feed-crop enterprises on the farm such as alfalfa, silage crops, and irrigated and natural pasture. Manufacturing-milk production with its lower milk price is profitable only in such areas. Management will be aided if each feed crop is considered a separate enterprise with a known production cost. Such products are charged to the dairy enterprises—milking herd and stock raising—at farm value. Farm value, the local price at which the product can be sold on the farm, may also be considered as local market price less marketing cost. For example, alfalfa hay stacked on the farm, if salable there for $20 a ton, would be chargeable to the dairy herd at this price per ton. If purchased and delivered from a near-by farm, it would probably cost $22.50 or more per ton. The table on page 46 presents a sample schedule of inputs and costs per acre for typical forage enterprises on dairy farms.

Enterprise accounting (see page 59) helps you to know the cost, income, and profit of the several enterprises in a dairy farm. Such information assists you in making important managerial decisions as to future courses of action—how much and what feed crops to grow, whether to enlarge or reduce the number of cows in the milking herd, and what to do to reduce costs or improve income in each enterprise in the dairy-farm business. The table on page 60 presents a summary of five enterprises and the total farm business for a 150-cow dairy farm.

THE MILKING HERD

The milking herd is the only enterprise now common to and comparable among all dairy farms. It is therefore possible to present sample budgets on the milking herd only. The tables on pages 14 and 15 present such a schedule of inputs, costs, and potential income for specific situations. The tables provide a standard to which you can compare your own milking herd.

Income to the milking herd consists of milk sales and sale of cull cows, the sale of calves and the value of heifer calves transferred to the heifer raising enterprise, and manure sales or credit for manure hauled to crop fields. In this circular, we show income from calves and manure as miscellaneous income which may also be deducted from total costs to show the net cost of the milk sold. Income from cull cows sold is deducted from the cost of replacements added, to show the net replacement cost. In private accounting, there would also be an increase or decrease in inventory value of cows on hand with changes in number during the year. The schedules in the tables on pages 14 and 15 assume no inventory change.

To make a milking-herd enterprise statement and analysis, you need to know the applicable costs. Purchased feed is charged at cost. Farm-produced feed must be known as to quantity and charged at farm value per ton or per animal unit month of pasture as defined on page 30. Labor and other costs charged to the milking herd should be just the applicable portion of each category of total farm expenses. The milking herd as an enterprise includes the cows both dry and milking, but not the raising of replacements or production and delivery of feed crops to the dairy.

The cost items and potential income in the table below are based on current information from several market-milk dairies in the San Joaquin Valley. They are not average cost figures but represent those for a well-managed enterprise of 150 cows, assuming an annual sale of 12,500 lbs of milk and 450 lbs of fat per cow.

SAMPLE BUDGET FOR A 150-COW GRADE-A MILKING HERD

Cost items	Quantity			Cost in dollars			
	Unit	Total	Per cow	Price	Total	Per cow	Per cwt
Concentrates	Tons	195	1.3	60.00	11,700	78.00	.63
Alfalfa hay	Tons	465	3.1	24.00	11,160	74.40	.59
Silage	Tons	555	3.7	9.00	4,995	33.30	.27
Green chopped forage	Tons	1,125	7.5	6.00	6,750	45.00	.36
Total feed cost					34,605	230.70	1.85
Hired labor	Hours	6,000	40	2.00	12,000	80.00	.64
Operator's actual labor	Hours	750	5	2.00	1,500	10.00	.08
Cows bought or transferred in	Heads	38	.26	300.00	*11,400*	*76.00*	
Less cows sold	Heads	36	.24	140.00	*5,040*	*33.60*	
Net cow replacement cost					*6,360*	*42.40*	.34
Breeding fees	Number	165	1.10	7.00	1,155	7.70	.06
Tractor and truck work	Hours	300	2	1.50	450	3.00	.02
Taxes (cows $585, facilities $495)					1,080	7.20	.06
Cow testing, DHIA					600	4.00	.03
Electricity $420, fuel $240					660	4.40	.04
Insurance compens. $460, soc. sec. $374, fire $135					870	5.80	.05
Repairs $900, vet $900, supplies $900					2,700	18.00	.14
General and office expense					1,500	10.00	.08
Management, share of operator's "salary"					3,000	20.00	.16
Depreciation, see page 53					2,710	18.06	.14
Subtotal cash costs and depreciation					69,190	461.26	3.69
Interest on investment at 6 per cent, see page 53					4,314	28.76	.23
Total cost of production					73,504	490.02	3.92
Less miscellaneous income:							
Small calves sold	Head	85	.57	15.00	1,275	8.50	.7
Heifer calves transferred	Head	46	.31	30.00	1,380	9.20	.7
Manure hauled out or sold	Tons	600	4	1.00	600	4.00	.3
Total nonmilk income					3,255	21.70	.17
Net cost of milk sold					*70,249*	*468.32*	*3.75*
Income (two alternatives)				Income, in dollars			
First alternative:							
(Net cost, from above)					70,249	468.32	3.75
Total milk income at 75 per cent Class I, rest other	cwt	18,750	125	4.70	88,124	587.49	4.70
Management income or profit					17,875	119.17	.95
Add operator's labor and management					4,500	30.00	.24
Interest on investment					4,314	28.76	.23
Operator's net farm income at milk sales 75 per cent Class I, rest other					*26,689*	*177.93*	*1.42*
Second alternative:							
(Net cost, from above)					70,249	468.32	3.75
Total milk income at 50 per cent Class I, rest other	cwt	18,750	125	4.20	78,750	525.00	4.20
Management income or profit					8,501	56.68	.45
Add operator's labor and management					4,500	30.00	.24
Interest on investment					4,314	28.76	.23
Operator's net farm income at milk sales 50 per cent Class I, rest other					*17,315*	*115.44*	*.92*

The table on page 14 illustrates the difference in net farm income for two different conditions: one, in which 75 per cent of the milk produced is sold as Class I; the other, in which 50 per cent of the milk is sold as Class I. You can recalculate your own potential income for your particular circumstances.

The cost items and potential income below are based on current information from manufacturing milk dairies in the Sacramento Valley. These are not average cost figures but they represent those for a good commercial manufacturing-milk herd with above-average production per cow. Assumed is an annual sale of 10,000 lbs of manufacturing milk per cow.

SAMPLE BUDGET FOR A 50-COW MILKING HERD
(Manufacturing-milk production)

Cost, income	Quantity			Cost in dollars			
	Unit	Total	Per cow	Price	Total	Per cow	Per cwt
Cost:							
Concentrates	Tons	50	1.0	60.00	3,000	60.00	.60
Alfalfa hay	Tons	135	2.7	20.00	2,700	54.00	.54
Irrigated pasture	AUM	400	8.0	7.50	3,000	60.00	.60
Total feed cost					8,700	174.00	1.74
Operator's labor and management	Hours	2,250	45.0	1.75	3,938	78.76	.79
Cows transferred in	Head	12	.24	275.00	*3,300*	*66.00*	
Less cull cows sold	Head	11	.22	135.00	*1,485*	*27.90*	
Net cow replacement cost					*1,815*	*36.30*	.36
Breeding fees	Number	55	1.10	7.00	385	7.70	.08
Tractor and pickup work	Hours	50	1.00	1.50	75	1.50	.01
Taxes					250	5.00	.05
Cow testing, DHIA					200	4.00	.04
Electricity and fuel					175	3.50	.04
Fire insurance for building, equipment, feed					30	.60	.01
Miscellaneous repairs, vet., supplies					400	8.00	.08
General and office expense					250	5.00	.05
Depreciation, see page 53					469	9.38	.09
Subtotal cash costs and depreciation					16,687	333.74	3.34
Interest on investment at 6 per cent, see page 53					1,046	20.92	.21
Total cost of production					17,733	354.66	3.55
Less miscellaneous income:							
Small calves sold	Head	34	.68	10.00	340	6.80	.07
Heifer calves transferred	Head	14	.28	25.00	350	7.00	.07
Manure hauled out	Tons	150	3	1.00	150	3.00	.03
Total nonmilk income					840	16.80	.17
Net cost of milk sold					*16,893*	*337.86*	*3.38*
Income:							
Milk sales at $3.30	cwt	5,000	100	3.30	16,500	330.00	3.30
Management income					−393	−7.86	−.08
Add operator's labor and management					3,938	78.76	.79
Interest on investment					1,046	20.92	.21
Operator's net farm income					*4,591*	*91.82*	*.92*

The table shows the difficulty of making much profit or paying good wages and feed prices with the low price of manufacturing milk.

MEASURES OF PROFIT

Profit may be figured differently by individual dairymen. In private accounting the inventory value of stock and feed on hand may or may not be considered. The value of the operator's labor and interest on investment are not usually included as costs, although interest paid on indebtedness would be. Net profit is therefore considered as the profit figure arrived at in private accounting with whatever cost groupings or accounting method used.

In budgets and in making comparisons between farms and years, a comparable profit figure should be used. A change in the stock inventory can be eliminated by assuming the number of head of stock on hand to be the same at the beginning and end of the year and by adjusting stock purchases, sales, and transfers to this basis. The inventory of feed on hand is eliminated by charging the feed actually used in the year. The value of the operator's and family labor should be included in expenses. Interest on the current or average investment in stock and production facilities should also be included. The difference between income and costs figured in this manner is called ***management income***—the net income available to reimburse the operator for his management.

Net farm income is the earning figure where the value of the operator's labor and interest on investment are not included as costs. It is obtained in the tables on pages 14 and 15 by adding these items to management income. Net farm income, in other words, is the combined earnings of the operator for his labor, management and all invested capital. It is a significant figure for the smaller dairy farms since it approximates the net profit as figured in private accounting and income-tax reporting.

For larger dairies with considerable hired labor and a large investment, the ***capital income*** is a useful figure in comparing earnings and figuring the rate of return on invested capital. It is computed by including any operator labor and usually an allowance for or the cost of management in costs, but no interest on investment. It is not shown in tables on pages 14 and 15 but appears in the table on page 60.

PROFIT IN THE MILKING HERD

THE MAIN FACTORS that determine profit are:

- Pounds of milk sold per cow.
- Price per hundredweight received for milk.
- Total cost per cow.
- Miscellaneous income from stock and manure transfers or sales.

PRODUCTION PER COW

Increase the average production of your cows, and your profit is likely to go up. Among the principal means of increasing milk production are improved feeding, breeding, and culling, and good management practices. To take the guesswork out of these improvement methods,

use records. Dairy herd improvement associations provide testing programs in all important dairying counties. Knowing each cow's production enables you to gradually eliminate poor cows and replace them with better ones.

California's great number of cows "on test" has resulted in improved production efficiency. In 1960, cows on test averaged 11,956 pounds of milk and 460 pounds of fat. Cows not on test produced only about 70 per cent of these figures—8,693 pounds of milk and 312 pounds of fat.

Feeding according to records

Each cow has a hereditary maximum production capacity. Assuming good management, the extent to which her production reaches this capacity is determined by the quantity and quality of the feed received. Many cows are unprofitable producers simply because they are not given as much feed as they could convert into milk. Feed accounts for 45 to 65 per cent of the cost of milk production on most California dairies. Price and cost considerations often influence the optimum feeding level. These include price received for milk, cost of grain and cost of roughage (hay, silage, green feed and pasture).

If, for example, grain is expensive and the price of milk relatively low, it may be profitable to feed less grain and to depend more on economical roughages even though less milk is obtained. If the price of milk is high and feed costs are relatively low, it usually is profitable to feed grain at a heavier rate. Whatever the ratio of feed cost and milk price, farm records properly interpreted will help you find the level of feeding that must be followed to obtain the maximum return from each cow in the herd. The subject of feeding and costs is discussed more fully on pages 29 to 40 under "Getting Maximum Return from Feed Costs."

Breeding according to records

The main objective of a breeding program is to improve the genetic ability of your herd. Breeding for improved ability is normally accomplished by saving heifer calves from outstanding cows that were mated to superior bulls. Breeding with sires that have proved to transmit this ability is the surest way to attain higher production per cow in the future. In 1961, 370,000 dairy cows, or 41 per cent of the California dairy cow population, were bred artifically. The influence of the sire cannot be overemphasized. It often is said, "The bull is half the herd." In California, from 20 to 40 per cent of the cows in a herd are removed each year and replaced by first-calf heifers or purchased cows. In this way, only 2½ to 5 years is required to obtain a herd largely composed of new animals.

Selecting a herd sire that will improve the herd is not simple. The California dairyman basically has three choices: he can take semen available at two cooperative artificial services and five private bull services, all but two of which have the sires located in California; he may use his own sire; or he may combine these possibilities.

Choosing sources of bull semen for use in artificial breeding requires careful thought. Some considerations are:

- *Reliability of service* in terms of properly trained technicians and dependable semen supply.
- *Conception rate*—getting the herd in calf with minimum number of repeat breedings.
- *Opportunity to select sires* wanted.
- *Information available on sires*, including

  Number of daughter-and-dam comparisons and level of producduction.

  Evaluation of type of daughters through type appraisal or official classification.

  Pedigrees of young sires with records and other information on the performance of parents and grandparents.

- A long-range program of the semen source giving assurance of continued availability of high-quality sires, and of breeding better sires through a scientific, selective mating system.
- Precautions taken to control communicable diseases that might be transmitted in the semen.
- The extent to which a dairyman may help direct the policies of the organization which he patronizes and share in its success, if he wishes to do so.
- The net cost of service.

Culling according to records

The removal of low-producing cows from the herd increases average production of the remaining herd. For intelligent culling, the testing of cows for production is a must. It is difficult to give any definite production level at which a cow should be eliminated, but as a general rule *any cow whose annual production does not pay direct feed and labor costs, and whose disposal therefore would result in a greater net income, should be removed at once.* It is important that the herd size, feed supply and labor force be kept in balance. Within this framework, any cow that can be replaced with a more productive cow should be replaced.

Several factors influence culling for production. One of them is the age of the animal. A first-lactation heifer is expected to produce about 75 to 80 per cent as much as a six-year-old, mature cow. A second-lactation heifer normally produces above 90 per cent as much as she will when mature. Other considerations for culling include: expected length of dry period, health and injuries, milking qualities, disposition, and type or conformation. Some of these factors are discussed below. A more complete discussion on "culling and factors affecting the decision" is found in leaflet AXT-11, "A Guide to Culling Dairy Cows," available from your local Farm Advisor or from Public Service, Room 131 University Hall, University of California, Berkeley 4, California.

Managing according to records

While high production often results from improved breeding and good feeding, other abilities also need constant study. Two of these are reproductive efficiency, particularly the proper calving interval; and the control of mastitis and other diseases.

Calving interval, or time between calvings, greatly affects the individual cow's lifetime record. Allowing only 10 or 11 months between calves reduces annual production by as much as 1,200 and 500 pounds of milk, respectively. On the other hand, if 14 or more months elapse between calves, the current record will be larger but probably the lifetime production will be less. Certainly there will be fewer calves born than if a 12- to 13-month calving interval can be maintained. Long calving intervals suggest breeding troubles caused by poor management or disease. Well-managed herds normally have 85 per cent or more of their cows freshening with a calving interval of 11½ to 14 months.

Season of freshening has considerable effect on production per cow in many parts of the United States, but in California the effect of this does not seem large or consistent among farms. However, there are conditions where dairymen may wish to adjust their season of freshening to the demand for their milk or to a climatic feed situation that influences costs of production. This is discussed more fully on page 21 under "Season and price."

Mastitis, either chronic or acute, continues to cause dairymen great financial losses because of lowered milk production, poorer milk quality, shorter herd life of animals, and high drug and antibiotic bills. California dairymen, however, are taking steps to reduce the incidence of mastitis, including a check of the milking equipment, improvements in

the managed milking procedures and, most importantly, sound prevention and treatment programs. The California Mastitis Test constitutes a valuable screening to detect the disease. During 1961, approximately 540 herds comprising more than 84,000 cows cooperated with the University of California on a mastitis control project. This project has gone into all phases of dairying, and involves the dairyman, herdsman, milkers, and veterinarian; and in some cases the distributor, health department and banker.

Other disease problems not yet completely controlled or eradicated include vibriosis, leptospirosis, calf-rearing ailments, ketosis, milk fever, bloat, and "hardware troubles." It is best to *prevent* these diseases possibly with the help of your local veterinarian, rather than to cure them. Many of the larger California dairies employ contract veterinarians who spend from one day per month to full time (depending on size of operation) on that dairy, advising on prevention practices as well as treating. Prevention programs have three principal aims: keeping down breeding troubles by giving the cow two examinations—one 30 days after refreshening, the second 40 days following breeding; sound mastitis prevention and treatment; and preventing outbreaks of other diseases. The usual contract is based on an annual fee with extra, but smaller than usual, charges for emergency trips and drugs.

The herd sire

The bull has two functions in the herd: to breed the cows for calves and milk; and to produce replacement heifers that will increase average production per cow.

The cost of service from an owned bull is usually an unsegregated part of dairy-enterprise expenses. Dairy bulls are normally kept in individual pens and, although they may receive some pasture, are fed largely on hay. Because of relatively high labor costs for feeding, cleaning the pen, and other tasks, annual maintenance costs usually approach $220. Ownership costs of depreciation, taxes and interest on investment vary widely with purchase and selling price of bulls, but probably average about $100 per year. These two costs combined total $320 per year. Records from a California bull stud indicate that annual maintenance costs total $280. Allowing $100 per year for replacement cost and assuming that each bull services 38 cows, the cost of natural service would be $10 per head.

The artificial insemination program as a means of herd improvement is now used on some 41 per cent of the cow population and probably more than half of the herds. Insemination services were reported in 47 California counties during 1960 by some 250 technicians and 50 veterinarians.

During 1960, 2,460 sires were used as bull studs in the United States. The average number of cows inseminated per sire was 2,816. Some of the better-proved sires, particularly in studs using frozen semen, accounted for 20,000 first services per sire. The advantages are obvious; the use of superior sires is greatly extended since by natural service a bull seldom is mated to more than 50 cows per year. Artificial insemination allows a good bull to be used on more cows within a herd and in more herds.

In most herds the cost of artificial breeding is less than the cost of natural service, particularly in the smaller herds. The average inseminating fee is $7 and will include one repeat service if necessary. As the use of frozen semen is expanded, dairymen have greater choice of bulls and can select their matings. Conception rates continue to improve and records of some studs indicate that conception is exceeding 70 per cent, which compares favorably with the conception rate of natural service.

Other advantages of artificial insemination are: infertile bulls are more quickly detected; disease control is helped; bulls are proven more reliably

and quickly; the danger of handling bulls is eliminated; the problem of using heavy bulls on heifers is eliminated; and the use of a superior bull may be extended.

PRICE OF MILK PER HUNDREDWEIGHT

Milk prices, in general, are largely determined by circumstances over which the individual dairyman has little or no control. The minimum prices of milk used for fluid milk and cream (Class I) are set by a state agency; and the price of manufacturing milk and market milk for other than Class-I usages are determined by supply and demand conditions off the farm and by price-support activities of the federal government.

Market-milk prices

The average price paid for all market milk produced in California depends on how much of it is used in the various classes, on the minimum price established for Class-I usage in the various marketing areas, and on the price of manufacturing milk. The Class-III price is based on how much is paid for manufacturing milk at various California creameries; the Class-II price is some specified value (quite often 20¢ per hundredweight) above the Class-III price.

The average price received by all producers for all market milk produced in California then is a blend price. The average or blend price received by an individual producer will vary from the state's blend price depending upon his location, the distributor to whom he delivers his milk, the distributor's usage pattern and, most important, the terms of the producer-distributor contract.

The milk-control law of California, as it appears in the *California Agricultural Code*, requires a written contract for all market milk purchased by dealers. The contract will normally specify the quantities of fluid milk to be purchased for some specified period, the quantity of such milk to be paid for as Class I, the date and method of payment, and the transportation charge if hauled by the distributor. The terms of the contract are usually determined by private negotiations between a field man of the dairy plant and each individual producer. The terms vary widely from distributor to distributor and from marketing area to marketing area. A producer in southern California might have a contract specifying that 80 to 90 per cent of his contract quantity be paid for at a Class-I price. Another producer located in the San Joaquin Valley might have a contract specifying a 10 per cent Class-I guarantee. These are minimums, however, and distributors pay for as much as they need to meet their Class-I requirements. The sale contract can be the Grade-A dairyman's most important price- and profit-determining factor. To obtain and retain a market-milk contract, he must produce high-quality milk and he must maintain the production level specified.

From 1956 to March 31, 1962 the minimum price for Class-I milk was specified in terms of a value for fat and a value for skim. Currently, minimum Class-I prices are specified in terms of a separate value for the fat, solids-not-fat, and fluid components of milk. The price for other classes is generally in terms of a hundredweight of milk adjusted for butterfat content through the use of butterfat differentials, but may vary from processor to processor.

In 1961, the established minimum price for 3.8 per cent milk used for Class-I products in the Kings–Tulare Marketing Area was $5.06 per hundred pounds from April through August and $5.52 during the other months. Of the important marketing areas this was the lowest established minimum price. Effective April 1, 1962, the seasonal adjustment was eliminated in all marketing areas and the minimum Kings–Tulare price was set at $5.29. However, the average or blend price received by producers for market-milk production, as reported by the Cali-

fornia Crop and Livestock Reporting Service, was about $4.72 per hundred pounds.

The average (or blend) price received by an individual producer for his total production is determined by the level of the minimum price established for Class-I milk, the going market price for manufacturing milk, and the relative proportions of milk that receive these prices as determined by his contract.

Effect of herd size on price and net income. Dairymen selling market milk sometimes increase herd size considerably beyond what they need to meet their marketing contracts. They do this to raise their net income or to utilize available labor more fully; and in the hope of obtaining an increased quota; in other cases they may have raised surplus heifers which they were unable to sell, and add them to their milking herd. But if they are unable to obtain a larger market-milk quota, they must ship their increased surplus to manufacturing-milk plants at a low net price, thus reducing their blend price and perhaps their net incomes. In such a case a budget test, as shown in the table on page 22, will help you judge the situation.

Manufacturing-milk prices

Presently, manufacturing-milk prices are determined by national rather than local conditions. Basically, the prices paid for manufacturing milk reflect the value received by creameries for the manufactured dairy products produced. The price a manufacturing-milk producer receives at his farm may vary slightly with his choice of plant to which he sells. The price will also vary seasonally, being lower in the summer than in the fall and winter. With a large quantity of market milk available for manufacturing purposes, more emphasis is being placed on the production of high-quality manufacturing milk; and premiums are being paid to manufacturing-milk producers for milk stored in refrigerated bulk tanks.

Manufacturing-milk prices have been slightly above or below $3.25 since 1954, with an average price of $3.20 in 1960. Since the price received for manufacturing milk is $1.50 to $2 below the minimum price for Class-I milk, manufacturing-milk producers have a strong incentive to shift to Grade-A milk production. However, shifts from manufacturing-milk to market-milk production are limited by the difficulty of obtaining market-milk contracts.

Season and price

For every region and every type of product there is a seasonal production pattern that best fits local feed and marketing conditions and results in the greatest profit.

The market-milk producer must maintain a specified production throughout the year to avoid a reduction in his contract. He can improve his average price by adjusting level of production through the year to market demand, thereby avoiding excessive seasonal surpluses to be sold at the lower manufactured-milk price.

Manufacturing-milk producers generally follow a pattern of freshening cows and seasonality of production that fits their seasonal supply of forage, even though prices of their product are usually higher in fall and winter than in spring and summer. Some could improve net income by a study of prices and costs at different seasons and changing to a production pattern that will result in highest profit.

Seasonal production may bring feeding problems which the dairyman must consider when determining the most profitable policy for his farm. Fresh, high-producing cows require almost twice as much feed as dry cows. Spring produces a high surplus of natural pasture, so this is the time to have the herd milking heavily. Some market-milk producers may find it profitable to have a spring surplus, even though this excess production over a base quota brings a manufacturing-milk price. This is an individual problem, requiring careful analysis.

This sample budget was drawn for an actual case: The herd had been increased to where 40 per cent of the milk was bringing $3.10 net per cwt. The herd was about the right size for the home-grown supply of forage. The farm was in an area where surplus hay could be sold locally, or cash crops could be grown on land not needed for a smaller herd. The question arose:

DOES IT PAY TO REDUCE THE HERD OF 92 COWS TO 71?

Income, cost	Unit	92 Cows		71 Cows	
		Quantity	Cost	Quantity	Cost
			Dollars		*Dollars*
Income:					
Class-I sales 80 per cent of contract at $5.15	cwt	6,906	35,566	6,906	35,565
Other milk sales at $3.10	cwt	4,594	14,241	2,294	7,111
Total milk income, average price $4.32, $4.62	cwt	11,500	49,807	9,200	42,676
Stock sales—cull cows, 27 per cent at $140	Animals	24	3,360	19	2,660
Calves sold and transferred at $20	Animals	82	1,640	64	1,280
Manure hauled to fields at $1 a ton	Tons	460	460	355	355
Total income			*55,267*		*46,971*
Cost:					
Concentrates bought at $64 a ton	Tons	115.4	7,386	93.7	5,497
Alfalfa hay at $25 a ton	Tons	200	5,000	200	5,000
Barley hay at $23 a ton	Tons	90	2,070	...	....
Green chopped alfalfa at $6 a ton	Tons	1,200	7,200	950	5,700
Corn silage at $8 a ton	Tons	198	1,584	200	1,600
Total feed cost			23,240		17,797
Labor and management, operator's	Hours	6,400	9,600	5,200	9,100
Cows transferred in, replacement at $300	Animals	25	7,500	20	6,000
Breeding fees	Number	100	770	78	546
Tractor and truck work			300		280
Rent dairy buildings and equipment			2,400		2,400
Taxes			450		400
Cow testing dues			360		300
Electricity and fuel			780		750
Miscellaneous repairs, vet., dairy supplies			1,600		1,550
Other and general expenses			500		490
Depreciation on owned equipment			700		700
Interest on investment cattle and equipment			1,980		1,680
Total costs			*50,180*		*41,993*
Net Profit			*5,087*		*4,978*
Farm Income, including labor and interest			*16,667*		*15,758*

The above budget test shows that, with rent staying the same and most other costs reduced little, there would be a reduction in net income, but close enough to suggest consideration of other factors such as less work for the two partners and other uses for the land not used for the smaller herd.

TOTAL COST PER COW

In determining profit in the milking herd, total cost per cow is almost as important as income. Some dairymen fail to attain a potential profit because costs are higher than necessary. On the other hand, some may practice false economies, such as inadequate feeding, resulting in low production and income.

In general, it is profitable to provide all the feed, labor, and facilities essential to high production, but to do it in the most economical manner possible.

Milk production requires inputs—cows, feed, labor, supplies, buildings, and equipment. Expenses are a result of these items and their prices. Prices or values of these inputs, the kinds and quantities used, and the way they are utilized vary widely from farm to farm. The dairyman has some opportunity for economy in obtaining and using inputs. He should know costs in detail, analyze each item and compare it from year to year and to published schedules. In the following cost discussion, figures are given a per-cow basis—the cost per average cow in the milking herd for a year, which would include dry or non-milking time.

Feed is the major cost—usually about 50 per cent or more of the total cost. It is here that, by skillful management, you can obtain the greatest cost reduction or increase your profit by making your production more economical. For a more detailed discussion on the expenses of feeding, see pages 29 to 40.

Cow replacement cost

The cow, the most essential input, represents a considerable investment. Usable on the average for four or five years, she must be replaced by the purchase of a new cow or a transfer from the heifer-raising enterprise. A transfer is charged to the milking herd at local farm value for such a heifer which is usually not far from the cost of purchased cows. Whether you will raise replacements or buy them is an important decision: it not only affects replacement cost but also the future productivity of the herd. Knowing the cost of raising replacements in a separate heifer-raising enterprise will help you in this decision.

Cows are culled for several reasons, such as low production, breeding troubles, disease. They are usually sold for beef at a price per pound much below the initial cost of purchase or raising. If a new cow costs $300 and you receive $140 for the cull, your replacement cost for that cow would be $160.

Replacement percentage in a herd varies with the dairyman's policy as to replacement age of his cows and his desire to increase the herd average production per cow. In a good healthy herd, using first-calf heifer replacements of good breeding, production per cow has been maintained with a replacement per cent as low as 20 per cent. On the other hand, with some purchase of older cows and the need to improve production per cow, some herds replace up to one-third or more of the cows in a year. A good standard in herds being maintained by adding their own artificially sired heifers is around 25 per cent.

Death losses must also be absorbed in replacement costs. Normally these are only from 1 to 2 per cent a year. If, in a 100-cow herd, 2 cows died, 23 cows were sold as culls and 25 new heifers were added at the prices mentioned above, replacement cost would be figured as follows: $7,500 for the new cows less 23 culls sold for $3,220 for a total herd replacement cost of $4,280, or $42.80 per cow.

Prices paid for cows or value of heifers raised and prices received for culls sold also influence net replacement cost. Raising heifers at cost less than the farm value, at which they are charged to the milking herd, will increase total farm profit, but in the heifer-raising enterprise, not in the milking herd. The heifer-raising enterprise is discussed on page 40.

Depreciation on cows may be included as an expense in private accounting, also profit or loss between book value and selling prices as cows are sold. Such depreciation would be equivalent to the net replacement cost as figured here, and therefore is not included in the cost schedules shown. In any herd, there is some increase or decrease in number of cows during the year, so increase or decrease

in inventory value of cows on hand will affect the net replacement cost as figured in private accounting. A herd being increased in size or one in which abnormally heavy culling is done to increase average milk production per cow will have higher stock or net replacement costs per cow. However, figures in the tables on pages 14 and 15 are based on no change in size of herd, and it is assumed that culled and dead cows are replaced by new cows.

Achieving the lowest possible net replacement cost per cow and maintaining or improving average production per cow requires good management in maintaining good health and condition of cows to reduce death losses and culling for disease. It also requires a good selection and careful buying of replacement cows or a good breeding program and selection of heifers to raise for replacement. A soundly planned replacement program, to have the best number of cows for your particular farm and milk-marketing contract, is important to future profits.

Breeding cost

The proper breeding of cows is important for two reasons. First, to obtain regular lactation periods of proper length; second, to transmit high production and other desired characteristics to the calf that may be saved and raised for replacement purposes.

Artificial insemination is now available at a reasonable cost in most California dairy areas. With cows coming and going during the year, there are about 1.1 services or more to pay for per average cow. Costs vary around $7.00 per cow served, so breeding cost is around $7.70 to $9.00 per average cow with this method. The sires available through this method are generally better than can be provided on individual farms in natural breeding.

Cost of natural breeding with owned bulls is usually greater than for artificial insemination, as discussed on page 19. In figuring costs in the milking herd using owned bulls, substitute calculated cost for the year for the breeding charge.

Labor costs

In recent years, higher outputs per dairy worker have been obtained because of better equipment and facilities, larger herds, and higher production per cow. Large dairies with hired milkers are handling up to 100 cows per milker. This has helped to keep labor cost per hundredweight of milk from increasing despite higher wage rates.

Detailed one-day labor input surveys were made in the Los Angeles area in 1951 and again in 1959. Studied were mostly corral dairies with forage purchased and replacements raised elsewhere. Striking reductions in labor use were noted. A few selected items, as reported in "Dairy Labor Use in Southern California," by H. Fisk Phelps, University of California, Riverside, are shown in the table below.

Dairy Labor in the San Joaquin Valley. A survey of labor use and costs was made in five counties in the San Joa-

Items	1951	1959
Number of dairies	111	123
Average number of cows milked per dairy on day of visit	168	201
Dairies with pipeline milkers (*per cent*)	13.5	47.2
Dairies with "walk through" milking barns (*per cent*)	6.2	10.6
Average number of total workers per dairy	4.5	3.3
Total worker minutes daily per cow in herd	10.2	6.8
Calculated hours per cow year	62.0	41.0
Pounds of milk per cow milked, day of visit	38.0	46.0
Hours of milking and helper labor per 1,000 lbs of milk	4.9	2.7

quin Valley in 1958 by local dairy farm advisors. The information was summarized by B. B. Burlingame but has not been published. On the 18 dairies covered, labor input was 45.6 hours per cow per year exclusive of care for young stock. Average hourly labor cost was $1.70 per hour which resulted in a labor cost per cow in the milking herd of $77.46 per cow. Average size of these dairies was 153 cows and annual production per cow was 10,339 pounds of milk and 423 pounds of milk fat. Several types of milking barns were observed with capacities of from 4 to 60 cows stanchioned at one time. Fourteen dairies, or 78 per cent, were using pipeline milkers.

Hours of man labor per cow per year in good-sized commercial dairies vary between 40 and 60. Fifty hours may be a good standard. Wage rates also vary considerably: from $400 to $500 a month or $1.75 to $2.00 an hour for milkers, and $1.25 to $1.50 for laborers used in feeding and other tasks. Our sample budget or standard for the 150-cow market-milk dairy on page 14 shows 45 hours per cow at $2.00 an hour for a total labor cost of $90 per cow which is 11 per cent of the total of all costs.

Compared with other regions of the United States, California, with its mild climate, large-scale, and specialized-type dairying has a lower labor requirement per cow. But, labor is still a major input in milk production. It ranges between 10 and 25 per cent of the total cost of milk production in different milking herds. In production-cost estimates for market-milk dairies by the Bureau of Milk Stabilization, it was 16 per cent in 1961.

A cost of this magnitude offers opportunities for important savings. They are being made through better buildings and equipment, and arrangement of lanes, corrals, and feed bunks, with more mechanical and self-feeding. Pipeline milkers have reduced milking time by up to 20 per cent as compared to the bucket-type machines. The smaller walk-through barn or milking parlor, with cows washed before entering, requires less labor than the older stanchion barn. By a system of gates and ramps, cows come to elevated stalls around the milker in some of the modern milking parlors, thus saving milker time and reducing the area to be cleaned.

Good labor relations help obtain and hold competent workers that are so essential to economical milk production. A study of labor-management relations on 40 market-milk dairies in Fresno County in 1952 (Giannini Foundation Mimeo Report 140) showed a rather high rate of turnover of employees: the average tenure was only 12 months for the 80 employees interviewed. Rates of pay, work performed, and other matters varied widely among individual farms. Main reason given by employees for changing jobs was "lack of sufficient time off." The confining nature of dairy work prompted workers to change jobs to obtain a vacation even without pay.

Since this study, some 10 years ago, increased herd sizes and other technical developments have made the interest, industriousness, and competence of dairy employees of greater importance to success and profit in dairy business. Good employer-employee relationships, adequate time off, and satisfactory working and living conditions and pay are essential to the high efficiency of milk production on large commercial dairy farms.

Management Costs

The management function of planning, the making and carrying out of business decisions, was previously considered an input by the owner-operator to be compensated for from profit or earnings over and above all other production costs. If the operator's management was good, he made a profit; if not, he failed to recover his costs. With current trends to larger dairies, however, management is becoming an important input over and above the labor and capital provided by the

operator. On some large dairies, management is hired.

The manager of the dairy provides a high type of service. His function consists of organizing the business; obtaining the capital; selecting and obtaining the land, equipment, and cows; and making the many administrative decisions in running the dairy and marketing the milk. The managerial and administrative functions, including office and accounting expenses, may lie between 5 and 10 per cent of other costs—up to $50 a cow. Although good management is an essential input in dairying for which there must be adequate compensation, this compensation can be earned by the higher profits resulting from its use. We do, however, include it in our budget of inputs and costs. Management is recognized as a production cost in the surveys by the Bureau of Milk Stabilization at about 5 per cent of the total cost of milk production. In the sample budget on page 14, management is listed as $20 per cow, or 4 per cent of total cost.

Miscellaneous Costs

This group of expenses contains all others not covered elsewhere—property taxes on cows and facilities, insurance, veterinary services, dairy supplies, repairs, electricity, fuel, production testing of cows, and truck and tractor work. This group, excluding breeding fees, may total from $40 to $70 a cow. These costs are mostly essential and beyond the control of the dairyman, but can often be reduced by good buying of the essentials only. However, skimping on needed supplies, disease control, adequate sanitation and refrigeration, and testing of cows would be false economy which might reduce income more than costs.

Some relatively fixed costs for the dairy herd as a whole can be reduced per cow by increasing the number of cows. Other costs fixed on a per-cow basis can be reduced in terms of cost per hundredweight of milk by getting more milk per cow. Cost savings in this group will come through wise buying of essentials and using facilities to full capacity.

Many dairymen are using rented facilities, and hence have a different cost grouping than the owner-operator. Rent paid for dairy lots and buildings would replace some taxes, repairs, and part of the depreciation and interest on investment mentioned below. Since rent usually approximates the annual cost of such facilities to the owner-operator, total cost per cow is about the same for a renter. Sample budgets shown on pages 14 and 15 are on the basis of the owner-operator. Rent is discussed more fully on page 57.

Depreciation

This is the portion of the original cost of buildings and equipment that should be charged to each year of use, to recover the original cost by the time each item must be replaced. Of several ways to estimate depreciation for each item, the commonest is the straight-line method: ultimate salvage value is deducted from the original cost, and the remainder is divided by the estimated years of useful life for each item. Total depreciation chargeable to the milking herd is the sum of the depreciation for all the items used by the milking-herd enterprise—the milking barn and milk house, hay and feed-storage barns, corrals with fences and paving, milking machine, milk storage and refrigeration equipment, and miscellaneous other items. Calf- and heifer-raising facilities should be charged to the heifer-raising enterprise and not the milking herd. Some buildings may need to be divided between the two enterprises for accurate cost determination.

Depreciation on cows, although taken on purchased cows in some private accounting, is not included here since it is covered in figuring the net replacement cost.

Interest on Investment

Dairying requires a considerable in-

vestment of capital. This input of capital has its cost in the form of interest on investment. Part of the capital is borrowed and interest is paid for its use. Another part is furnished by the operator and interest is his compensation for its use. This properly is figured at a rate he could obtain elsewhere in an investment with similar hazards. For simplicity, we figure interest here on all invested capital at the average rates currently paid on borrowed funds secured by real estate and cows—about 6 per cent. The tables on pages 53 and 54 show a typical current investment and depreciation for two sizes and types of dairies and in sections for the milking herd, heifer-raising enterprise and forage production or farming enterprises.

Since buildings and equipment depreciate in value throughout their useful lives from cost to salvage value, we have assumed an average lifetime value, in order to figure interest on investment. This average value is a little more than half the original cost. For cows, it is about midway between cost and salvage value.

In private accounting, interest on debts is a current cash expense. But interest on the operator's investment is seldom figured as a cost. However, the dairyman would do well to figure his investment and the rate of return he receives for its use. From his profit, he deducts a proper allowance for his own labor and management and considers the balance a return on his capital. He may find it anywhere from a loss to a gain up to 15 per cent of his invested capital. If it is a loss, he will want to do something about it—improve his business to make a fair return or sell out and invest his capital elsewhere and obtain other employment for his labor and managerial services. Average returns to capital invested in land have been from 3 to 5 per cent in recent years. Management in dairy farming must probably be above average to obtain a return of 5 per cent or more on invested capital.

STOCK AND MISCELLANEOUS INCOME

In the usual commercial milking-herd enterprise, this income is usually small and not important in determining profit. It must, however, be included for accuracy in enterprise statements and analysis. Calves sold or transferred to a heifer- or stock-raising enterprise are credited to the enterprise for the amount received or their farm value at the time of transfer. Their farm value consists in their price, less the cost of selling. The manure from the barns and dairy lots also is income to the dairy as sold or at farm value as picked up in the lots to be hauled to crop enterprises.

Cull cows, as mentioned, are deducted from cows bought, to obtain the net replacement cost (see page 23). Bull purchases and sales are handled in the breeding cost (page 24), thus are seldom an item of income.

Some dairymen raise additional bull or heifer calves for sale as breeding animals or for veal or beef. These are best handled in the heifer-raising enterprise and not as part of the milking herd. Milk used in starting calves is usually ignored and not credited to the milking herd and charged to the calves, but it should be if it is considerable. True veal is produced mainly on whole milk with about 10 pounds of milk to a pound of gain. Hence, only calves with high birth weight justify this high-cost feeding and only when veal prices are high in relation to the farm value of milk.

Feeding for veal production

Whole milk alone, without supplements of grain or hay, is most satisfactory for producing the best grade of veal. Considerable experience is required for producing the most rapid growth without causing the calf to go off feed. As a rule, the one- to two-week-old calf will take approximately 1 pound of milk per day for each 10 pounds of body weight. Later the

amount of milk should be increased gradually according to the judgment of the feeder. Calves raised by nurse cows usually grow faster, with fewer digestive disturbances, than bucket-fed calves. About 10 pounds of milk per pound of gain is required and daily gains of 2.0 to 2.7 pounds can be expected.

Most veal calves are marketed between four and eight weeks of age. They are first classified according to weight and later according to conformation, finish, or smoothness of fleshing. Calves of 110 pounds or less are referred to as light weight, those of 110 to 180 pounds as medium weight, and those of more than 180 pounds as heavy weight. Well finished vealers weighing 140 to 155 pounds and occasionally up to 180 pounds, which are marketed at six to eight weeks of age, bring higher prices. The quality of the veal is the most important factor in determining the price the producer will get for his calf.

With milk for manufacturing purposes or surplus grade-A milk worth about $3.30 per hundredweight, feed costs for 70 pounds of gain would approximate $21. Add to this $20 for the value of a calf and $4 for labor and other expenses, and the total costs will be around $45 at marketing time—more than 30¢ per pound.

Dairy steers for beef

It rarely pays a dairyman to raise steers for beef. Feed and facilities on a dairy farm are usually more profitably employed in milk production and for raising heifers for replacement purposes. According to one recent study (Circ. 23, University of Nevada, 1959), to bring a dairy steer to 1,100-pound market weight requires $195 for feed, labor and purchase price of calf if hay is valued at $25 per ton. Where a dairy farm has surplus low-cost pasture for feed, it may pay to raise a few surplus male calves for beef. Holstein steers make economical gains on pasture, and although they bring less per pound, they cost less to start with than a beef calf.

Raising registered cattle

The dairyman with registered dairy cattle is both a producer of milk and a supplier of seed-stock cattle for the improvement of the breed. Milk is still the major part of the income on such farms. Either production per cow must be higher than in grade commercial herds to justify the expenses of the breeding, registration, "official" testing and type improvement programs, or considerable income must be received from sale of stock.

The influence of the registered cattle breeder on the dairy cattle industry is considerable. It is true that the increased use of artificial breeding has reduced the market for purebred bulls; but this only places a greater responsibility on those "breeders" that do supply artificial studs with replacement bulls. In 1961, an estimated 125 bulls were used on the 370,000 dairy cows bred artificially in California. Also, many commercial dairymen try to improve their herds through a constructive breeding program by purchasing high-quality registered bulls from the breeder.

The breeder is always confronted with the problem of selling his stock at a profit. Many breeders sell by auction; others by private agreement. In either case, salesmanship is most important, and a breeder lacking this quality often finds it difficult to reap the rewards his superior breeding animals justify.

In California during 1961, registered herds averaged 21 pounds more butterfat per cow than grade herds. This difference could be even greater were it not for the fact that the breeder, hoping to get one more valuable offspring, often keeps cows longer than the commercial dairyman can justify.

Feed represents 45 to 65 per cent of the total cost of milk production. Sound economy or wasteful extravagance can influence this cost considerably. Most dairymen have some opportunity to increase their net profit either by reducing feed costs without reducing income or by increasing income without greatly increasing feed costs. For terms used in analyzing costs and feeding practices, see box on page 30.

THE FIVE MAIN TYPES OF FEED

Concentrates are relatively high in energy and low in crude fiber. They may contain large amounts of protein (i.e., cottonseed meal) or carbohydrates (i.e., barley). Some concentrate feedstuffs may contain up to twice as much energy per pound of dry matter as forages. Concentrate mixtures probably average about 70 mcal/cwt, but range from about 65 to 75 mcal/cwt. Concentrate mixtures containing 12 or more per cent crude fiber are generally considered low-quality mixtures. There are exceptions, however; for example, beet pulp contains about 75 mcal/cwt (high in energy) but has a relatively high crude-fiber content (about 15 per cent). Concentrates must be fed to meet the total energy requirements of high-producing cows, even though ample good forage is available. In addition, concentrate mixtures are formulated to supply protein, minerals and vitamins as they are needed to supplement the forage consumed and to insure balanced rations.

Hay is the main source of forage for California dairy cows. Most of it is alfalfa, which is or can be highly palatable, and is adequate to meet most protein and mineral needs. Cows may consume from 2.5 to 3 pounds of alfalfa per 100 pounds of body weight depending on quality and amount of concentrate eaten. Most hays contain around 40 mcal of net energy per cwt. Hay quality is influenced especially by stage of maturity and extent of leaf shatter. Both result in higher crude fiber, and as crude fiber increases, hay quality

The net energy content of hay and other feed types varies with their moisture and fiber content. This table shows energy contents and costs typical of the San Joaquin Valley. You may use it to calculate your feed needs and costs. If obtainable, substitute energy contents and prices applicable to your particular situation.

HOW TO CALCULATE FEED NEEDS AND COSTS

Feed	Unit	Mega-calories	Quantity equivalent to 1 ton average hay	Sample cost per AUM or ton	Cost per 100 mega-calories	Cost per ton hay equivalent
				Dollars		
Pasture						
Good natural, coast counties	AUM	320	2.5	4.00	1.25	10.00
Irrigated—on crop land	AUM	320	2.5	8.50	2.62	21.25
Irrigated—shallow land	AUM	320	2.5	7.50	2.35	18.75
Alfalfa hay-producing areas						
Good—23 per cent crude fiber*	Tons	880	.9	24.00	2.72	21.60
Average—27 per cent crude fiber	Tons	800	1.0	22.50	2.81	22.50
Poor—31 per cent crude fiber	Tons	700	1.1	21.00	3.00	23.10
Green chopped alfalfa	Tons	210	4.0	5.80	2.76	22.10
Corn silage	Tons	267	3.0	9.00	3.37	27.00
Usual dairy concentrate mixture	Tons	1400	.6	60.00	4.29	36.00

* Crude fiber on a 10 per cent moisture basis.

Terms Used in Analyzing Feed Costs and Feeding Practices

Net Energy (NE) is the net portion of the feed available for production. For practical purposes, **body maintenance** and **milk production** are the main considerations for rations of lactating cows. Net energy, expressed as megacalories[1] per hundredweight (mcal/cwt) is more accurate than total digestible nutrients (TDN) for comparing the relative energy values of roughages and concentrates. This is because net energy accounts for gaseous losses, urinary energy losses and heat losses, in addition to fecal energy losses. This circular uses *net energy* because it discusses relative values of different classes of feeds and not details on feeding standards.

[1] A *megacalorie* is a term used to measure heat and its use is preferable to that of "therm." Both terms indicate 1,000,000 small calories.

Animal Unit Month (AUM) is the amount of feed required by one mature head of cattle for one month. It is equivalent in nutrients to 0.4 tons of average hay, or 320 mcal of energy.

Feeds are measured and sold by weight in pounds or tons. For convenience, we use tons. An exception is pasturage eaten by an animal which is not weighed but is rented or sold at a certain price per head per month. Animals of different size vary in the amount of feed they eat, so a standard unit of measure—*AUM*—is used.

Hay Equivalent (HE), another convenient expression for total nutrients, means the energy equivalent of 1 ton of hay which, on the average, contains 800 mcal of net energy. With an AUM being equivalent to 320 mcal of net energy, 2.5 AUM are required to furnish the same amount of energy as 1 ton of hay. The table on page 29 shows hay-equivalent factors for the other type feeds. To convert a given number of AUM's of pasture to hay equivalent, divide that number by 2.5 or multiply by 0.4. These relationships are useful in dairy farm management when adding up all feed used to see how this compares with the feed probably needed, and in breaking down the annual feed needs into the most economical proportions of types of feed, both home-grown and purchased.

Fat-Corrected Milk (FCM) is a term used to express milks of different composition on a standard-energy basis. Four per cent FCM is calculated by multiplying the actual milk yield by 0.4, and then adding to this product the actual fat yield multiplied by 15. For example, suppose a cow produces 60 pounds of milk containing 3.5 per cent fat (60×3.5 per cent) or 2.1 pounds fat. Fat-corrected-milk production, then, is ($60 \times .4$) plus (2.1×15), or 55.5 pounds of 4 per cent milk. The table on page 32 indicates expected change in milk yield as daily grain levels are increased. These changes are in terms of 4 per cent milk. If your cows test only 3.5 per cent butterfat, the expected change would be about 8 per cent greater. If your bulk milk contains 5.0 per cent butterfat, the expected change would be about 15 per cent less than indicated.

decreases. The University of California has developed a simple, reliable chemical test for determining alfalfa hay quality. The value and the use of this test are discussed on page 38.

Modern methods of mechanized harvesting have made hay production possible in areas where it is a profitable crop, and from which it may be transported for use in other areas. Thus, its availability the year around makes it a basic dairy feed. Even stock on irrigated pasture or green feed need and usually receive some hay for greater total consumption and higher energy intake.

Silage can be made from several crops, but corn and sorghum are used most often. Some silage from alfalfa, and mixtures such as oats and vetch or grasses and clovers, are being made and used successfully. Silage is fed where it can be grown and stored more economically than hay, and substitutes for much of the hay. Some dairymen use it in the belief that added succulence to an otherwise dry ration improves production. Tests and experience have shown, however, that satisfactory results can be obtained with or without silage or other succulent feeds.

Because of moisture differences, silages are compared with hay on a dry-matter or hay-equivalent basis. Usually, about 3 pounds of silage are considered equal to 1 pound of hay. The energy content usually varies around 13.4 mcal/cwt. Corn silage from well-eared corn is an excellent feed for dairy cows if supplemented with additional protein. Grass and legume silages are usually higher in protein but may be lower in energy than corn silage. Sorghum silage usually contains less energy than corn silage but is a satisfactory feed.

Green feed, freshly chopped from alfalfa or grass and legume mixtures, is often used as a replacement to pasture and instead of silage during the growing season of approximately eight months. Green feeding has the disadvantage that a crop may not always be available at the proper stage of maturity so that quality is not uniform. During peak production periods, there is usually an excess which may be put up as hay or silage. The feeding value of chopped green alfalfa is about 10.5 mcal/cwt, but may be considerably less depending on stage of maturity and moisture content. The amount of green chop equivalent to 1 pound of good quality alfalfa hay may vary from 3.8 to 4.0 pounds. Before going into a green-feed program, a dairyman should make careful calculations of the probable costs in relation to alternative programs.

Pasture quality varies considerably and is affected greatly by grazing practices and management. When land has alternative uses such as for alfalfa or row-crop production, irrigated pastures generally require annual yields of at least 12 AUMs before they are economically feasible. Few dairymen do this well in their pasture management and many will find their pasture costs almost as high as that of hay. Lower-cost irrigated pasture will be found on shallower soils unsuited to alfalfa and other crops.

Natural pasture is cheaper than irrigated pasture and other feeds. It is widely used for heifers and dry stock and, to a considerable extent, for milking herds in the coastal counties. It is the main feed in seasonal manufacturing milk production in nonirrigated areas. However, the natural feed is good for only about four months, so considerable hay and silage must be depended upon during the remainder of the year.

GOOD MANAGEMENT IN FEEDING

The composition of diets for milking cows can be flexible, allowing several alternatives in combining feedstuffs to achieve an economical feeding program. Feed costs may be regulated by manipulating the relative amounts and types of ingredients in the ration to be fed.

Experimental evidence and practical

experience clearly show that economical levels of milk production are not usually obtained on all-roughage diets. The main reason for this is that the cow has only a limited capacity and cannot consume sufficient energy by roughage alone. U. S. Department of Agriculture researchers found that cows fed an all-forage ration produce about 30 per cent less milk than cows fed grain in average amounts. To obtain even this production, the forage must be of good to excellent quality.

An all-concentrate or very high-concentrate diet, on the other hand, may have undesirable consequences. When the consumption of coarse roughage is below 5 or 6 pounds per day, the percentage of butterfat in the milk may become low. To date no control for this response is known, other than including at least some coarse roughage in the diet.

The prevalent practice on most California dairy farms is to feed a given amount of concentrate per cow, letting the cow eat as much roughage as she wants. To determine how much concentrate you should add to make the ration most profitable, follow this rule of thumb: *Keep increasing the level of grain as long as the added returns from the milk more than offset the cost of the added feed.*

Recent research on this matter was conducted by the University of California and published in the proceedings, 14th Annual California Animal Industry Conference, 1961. The research, estimating input-output relationships with dairy cows, reached the following conclusions:

- When grain intake increases, hay intake decreases at an increasing rate.
- Maximum feed consumption, when good quality alfalfa hay is fed, is usually reached when the grain consumption is about 16 pounds daily per cow.
- Maximum energy intake is not approached until cows receive more than 20 pounds of grain daily.
- Increased grain intakes at high grain-feeding levels result in less added milk than same amounts of added grain at the low grain-feeding levels.
- Cows with high inherent productive capacity show greater response to grain feeding than cows of lower ability. Therefore, higher levels of concentrate feeding are justified for the cows of high ability.
- The response of high-concentrate feeding is less in cows in late lactation than in early lactation. If a feeding program is based on predicted milk response, the ability of cows to meet the theoretical conditions can be used as a guide for culling.
- The economic levels of concentrate feeding are higher when common-

EFFECT OF INCREASED GRAIN FEEDING LEVELS ON HAY CONSUMPTION AND MILK PRODUCTION

Increasing daily grain from	Per cow		
	Change in monthly grain	Change in monthly hay intake	Change in monthly fat-corrected milk yield
Pounds			
6 to 8	+60	−36	+75
8 to 10	+60	−39	+63
10 to 12	+60	−45	+57
12 to 14	+60	−54	+45
14 to 16	+60	−60	+33
16 to 18	+60	−69	+27
18 to 20	+60	−75	+18

quality roughage is fed than when good-quality roughage is offered. The higher the quality of roughage, the less the increase in milk production when grain feeding is increased.

The data from which some of the above conclusions were drawn are summarized in the table on page 32.

The following three examples demonstrate the economic principle and show that different situations may yield quite different answers. These data may not apply to cows in the late stages of lactation where the expected milk production response is less than that expressed in the table on page 32.

Example 1: Market-milk producer, Los Angeles Area

In this example we assume a milk price of $5.00 per cwt, with grain at $62.00 and alfalfa hay at $32.00 per ton. By increasing daily grain from 18 to 20 pounds, monthly income over feed cost would increase 24 cents per cow. At this level of grain feeding, response in milk yield would be 18 lb per month or 0.6 lb per day. This small increase—worth only 24 cents—indicates that, on a herd basis, still more grain would result in little, if any, additional response. If grain mixtures cost $70.00 per ton instead of $62.00 as in our example, the 20 lb daily grain schedule would be optimum.

Example 2: Market-milk producer, San Joaquin Valley

This example assumes that the Valley dairyman obtains his concentrate mixtures for $66.00 per ton, buys hay for $26.00 per ton and receives $4.50 per cwt for his milk. In this case, 18 pounds of grain mixture is the most profitable feeding level—addition of another 2 pounds would increase costs more than returns.

EFFECTS OF INCREASED GRAIN FEEDING ON MONTHLY INCOME
(Los Angeles market-milk conditions)

Increase daily grain from	Per cow per month		
	Net added cost of hay and grain	Value of added milk produced	Change in net income
Pounds	*Dollars*		
14 to 16	.90	1.65	+.75
16 to 18	.76	1.35	+.59
18 to 20	.66	.90	+.24

EFFECT OF INCREASED GRAIN FEEDING ON MONTHLY INCOME
(San Joaquin market-milk dairy)

Increase daily grain from	Per cow per month		
	Net added cost of hay and grain	Value of added milk produced	Change in net income
Pounds	*Dollars*		
12 to 14	1.28	2.03	+.95
14 to 16	1.20	1.49	+.29
16 to 18	1.08	1.22	+.14
18 to 20	1.00	.81	−.19

Example 3: Manufacturing-milk producer

Consider the situation of a dairyman producing milk for manufacturing purposes. Allow a similar concentrate price of $66.00 per ton, but assume that reasonably good roughage is fed for a hay equivalent price of $20.00 per ton and that he receives $3.25 per cwt for his milk. Under these conditions, 14 pounds of grain mixture daily is the optimum level. If good native pasture is available and its hay equivalent cost is $16.00 per ton, 12 pounds of grain would be the maximum profitable level.

While the three examples indicate the general principle to follow in selecting profitable rations, there are several complicating factors. The methods discussed here apply only to herd-average feeding schedules. The dairyman may vary the exact amount considerably from cow to cow, according to cow ability, stage of lactation, and individual response to concentrate feeding.

Furthermore, it is known that when poor roughage is fed, economic levels of grain feeding are considerably higher. Complicating this, however, is the fact that when grain consumption increases and roughage consumption is lowered, the grain mixture may need protein supplementation. In this event, the cost of the added protein needed should be included in determining the most profitable ration.

Feeding according to production

The amount of grain mixture needed by the individual cow depends not only on her yield of milk and fat but also on the amount and quality of the roughage she eats. A number of rules of thumb are in common use, but few of them are appropriate under all conditions. One divides daily milk by a factor of 3 or 4, and a second divides monthly butterfat production by 5. Both of these tend to *overfeed the low producers.* A third method is to subtract 25 from the pounds of monthly butterfat produced and divide the remainder by 2. This system tends to *overfeed the high producers.* Most other systems are rather awkward to use and many of them fail to recognize the fact that as grain consumption is increased, roughage consumption is decreased.

The suggested grain feeding schedule found below is based on the table on top of page 35.

- Roughage consumption decreases as the amount of concentrate offered is increased.
- Cows producing more than 75 lbs of butterfat per month probably are on an energy-deficient diet. A portion of the energy required for this high production is supplied by body reserves.
- Cows producing 30 lbs or less butterfat monthly probably require no concentrate if the roughage contains at least 40 mcal of energy in each 100

EFFECT OF INCREASED LEVEL OF GRAIN FEEDING ON MONTHLY INCOME
(Manufacturing-milk dairy)

Increase daily grain from	Per cow per month		
	Net added cost of hay and grain	Value of added milk produced	Change in net income
Pounds	*Dollars*		
8 to 10	1.59	2.05	+.46
10 to 12	1.53	1.85	+.32
12 to 14	1.44	1.46	+.02
14 to 16	1.38	1.07	−.31

SUGGESTED GRAIN-FEEDING LEVELS FOR INDIVIDUAL COWS WHEN HIGH-QUALITY ROUGHAGE IS FED FREE CHOICE

Monthly butterfat	Daily fat-corrected milk	Daily grain mixture per cow	Probable hay equivalent consumption
Pounds			*lb/cwt of animal*
30 or less	26 or less	2*	3.0
35	29	4*	2.9
40	33	6	2.8
50	42	10	2.7
60	50	15	2.6
70	58	19	2.5
80	67	23	2.4
90 or more	75 or more	28	2.3

* Additional grain may be desirable for proper conditioning of the cow.

lbs of hay equivalent. However, some grain may be desired to condition the cow for the next lactation.

Feed use per head

Checking feed use against a standard or average may be helpful in analyzing a feeding program for overfeeding and waste, or underfeeding. The table on page 29 is presented as a suggested standard for comparison of feed use by dairy stock. These figures are calculated for herds comprising mainly the larger dairy breeds (Holsteins and Brown Swiss). Feed use in herds with smaller cattle will be slightly less.

To make a comparison to these standards, you need a fairly accurate accounting of the following factors:

- Average number of cows for the year—count once a month or obtain from DHIA records.

STANDARD FOR COMPARING FEED USE BY DAIRY STOCK

		Period fed	Net energy		Quantity for period	
			Average per day	Total for period	Concentrate	Forage
		Months	*Mcal*		*Tons*	*Tons HE*
Calves to 2 mo., not incl. milk or milk replacer		2	.7	40	.04	.01
Calves 2 months to 1 year		10	5.6	1,700	.43	1.38
Heifers 1 to 2 years		12	8.0	2,920	.09	3.50
Heifers 2 to 2 1/3 years		4	13.0	1,560	.09	1.79
Heifers 2 to 3 years		12	11.0	4,000	....	5.00
Bulls		12	13.2	4,800	....	6.00
Average production of cows						
Milk (FCM)	Butterfat					
7,500	300	12	15.6	5,690	.61	6.05
8,000	400	12	16.0	5,850	.70	6.09
10,250	450	12	18.1	6,600	1.27	6.04
12,500	500	12	20.1	7,340	1.83	5.97
14,750	550	12	22.1	8,080	2.40	5.90

- Number of bulls and young stock fed through the year—from occasional counts or inventory records.
- Total quantity of each type of feed used during the year:

  Concentrates—add up feed tags.

  Hay—record hay grown plus hay bought corrected by inventory of hay on hand at beginning and end of year.

  Silage or green feed—tons grown or purchased corrected by inventory of silage on hand at beginning and end of year. May be measured by counting loads.

  Pasture—record of actual use by age groups for each kind of pasture each month.
- Pounds of butterfat produced—from DHIA record or figured from sales.

The feed use shown here is typical of dairy animals of the larger breeds and somewhat above Morrison standards, to allow for a little waste. Feed shown for calves is in addition to milk or milk replacer. The last section shows total feed for the period as usually divided between concentrates and forages, with the latter expressed in tons of hay equivalent.

Illustration of a check on annual feed use: A herd with 69.5 average cows for the year and raising calves and heifers had this total year's feed use.

FEED	CONCENTRATES, TONS	AUM PASTURE	HAY EQUIV., TONS
Calf meal	1.2		
Concentrates	106.8		
Hay, all bought			475.8
Irrigated pasture		94	37.6
Rented pasture for heifers		335	134.0
Total	108.0		674.4

Here are the feed requirements for all animals in the herd during the year as computed from the previous standard.

STOCK	CONCENTRATES, TONS	HAY EQUIV., TONS
Calves 0–2 months, 24 head, through this 2-month period, 24 times .04 T concentrates and .01 T hay equivalent	.96	.24
Calves 2 mo. to 1 year, 15.6 head, through this 10-month period, 15.6 times .43 T concentrates and 1.38 T hay equivalent	6.71	21.53
Heifers 1 to 2, 17 head times .09 T concentrates and 3.50 T hay equivalent	1.53	59.50
Heifers over 2, 6 average for year at 5.0 T hay equivalent		30.00
Subtotal, young stock	9.20	111.27
Subtracting above young stock use from total leaves probable feed used for cows	98.80	563.13
Standard for 69.5 cows, average production 12,500 lbs 4% milk, at 1.83 T concentrates, and 5.97 T of total hay equivalent	127.19	414.92
Difference	–28.38	148.21

Concentrates fed were 22 per cent below the standard. The surplus of 148.21 tons of total hay equivalent in hay and pasture was not all used by cows, since 111 tons was the need for the heifers, but 134 was in the rented pasture for heifers. Deducting this 23 tons of surplus hay equivalent to heifers leaves 125.21 of surplus to the cows, about 30 per cent above the standard requirement. The 28.4 tons of concentrate shortage converts to 47.3 tons of hay equivalent which would reduce the surplus of hay equivalent to 96.8 tons. This would still be excessive and indicates poor quality and considerable waste. Obviously this information would result in the operator increasing the concentrate feeding to cows and more attention to forage quality and the quantity used.

Selecting and purchasing concentrates

Wise buying of feed will help insure a profit in dairying. Mixed concentrates in bulk by truck loads are usually bought at current market prices. There is little opportunity to take advantage of seasonal "lows" in grain prices by buying single ingredients to be stored for feeding later unless the operation is sufficiently large to justify storage, grinding and mixing facilities. You may, however, save money by taking advantage of competitive prices for concentrates of the quality and kind required.

Concentrates in dairy rations are mainly needed to supply adequate energy; under certain conditions also to balance the protein and, in rare cases, vitamin A. When alfalfa hay or green feed is the primary source of roughage, concentrates are needed only for energy. However, salt (mineral) should be provided either in the concentrate or offered free choice in the corral.

Under California regulations the feed tag must list the names of the ingredients in the order of decreasing amounts present; minimum amounts of crude protein and crude fat; and maximum amounts of crude fiber and ash.

From these basic requirements, a student of *feeding programs* can estimate with reasonable accuracy the relative amounts of energy and digestible protein contained in a concentrate mixture. Generally, about 75 per cent of the crude protein is digestible and actually used by the cow. The energy content is estimated by determining the relative amounts of each feed ingredient and by the crude fiber content. Usually feeds high in crude fiber contain less energy than feeds containing lower amounts of crude fiber. Beet pulp is an exception since its fiber is more highly digestible than the fiber in most feeds. Unless beet pulp is near the top of the list of ingredients, one can usually assume that feeds containing more than 12 per cent crude fiber are relatively low in net energy (below 66 mcal/cwt). Feeds containing 10 to 12 per cent crude fiber are usually medium-energy feeds (66 to 70 mcal/cwt), and feeds containing less than 10 per cent crude fiber and comprising mainly high-energy ingredients probably contain from 70 to 75 mcal of net energy in each 100 pounds.

Before ordering a concentrate mixture determine how much protein is needed to supplement the roughage. This is important because high-protein feeds are often the most expensive component of the concentrate mixture. When plenty of good legume forage is offered, a crude-protein content of not more than 12 per cent in the grain mixture is usually adequate. However, do not restrict the amount of protein for a high-producing cow, since protein is not effectively stored in the cow's body. A shortage of protein will result in lower production, regardless of the feed's energy content.

Good forage at low cost

Forages furnish most of the feed used in the dairy enterprise, and its cost can greatly influence profit. Whether to produce milk largely with purchased hay, as in a corral dairy, or have more land and grow one's own forage is an important question that each dairyman must answer. Several factors influence this decision.

Location of land available may be the controlling factor. A corral dairy in a metropolitan area is usually limited to hay brought from distant producing areas. Farther out, where there are some farming possibilities, some of these dairies may use a little green feed or silage to supplement purchased hay, even though its production may result in nutrient costs as high as in the hay that is bought.

Alternative use of the land is a major factor in many areas. In farming regions with good soil adapted to a wide range of crops, high land values, taxes, irrigation water and other costs may result in forage production costs too high to offer any

advantage over purchased hay. Also, the same land may be of greater value for producing cash crops such as cotton or vegetables and thus not be desirable for pasture or silage production even though such feed could be produced more cheaply than purchased hay.

The size of the herd is another contributing factor. Dairymen managing relatively small herds may not be able to justify expensive green-chop equipment while irrigated pastures may be rather easily managed. On the other hand, it may be difficult for dairymen with large herds to manage properly a pasture program, while the investment necessary for a green feed or silage program may be quite profitable. Ask your Farm Advisor for help in analyzing your farm business and in developing your most profitable forage program.

The cost of hay, green feed, silage and/or pasture per unit of energy should be considered in choosing the type of roughage to be used. Unless reliable estimates of the energy content are available from specific analyses, use the data in the table on page 29 for determining relative values. For alfalfa hay, a rapid and accurate chemical test is available for determining its energy value (see below).

The feeding value of hay varies with stage of maturity and extent of leaf shatter. Both affect the level of crude fiber. To be of high quality, hay must have a low crude-fiber content; as fiber increases, hay quality decreases. Digestible protein is also closely related to the crude-fiber content. Consequently, only two analyses are needed to evaluate alfalfa hay—a dry-matter determination and a crude-fiber determination. These values will indicate *net energy* and *digestible protein*.

Baled alfalfa hay will usually dry out to about 90 per cent dry matter in the barn. Hay purchased or fed at lower dry matter levels contains more water and less energy than 90 per cent hay. On the average, each 1 per cent decrease in dry matter reduces feeding value of alfalfa hay by approximately 1 per cent. According to Marin County field observations, dry-matter content of tested hay varies from about 78 to 90 per cent. This means that a pound of the hay with the lower dry matter has only seven-eighths as much per unit of weight as the dryer hay if both have the same quality in other respects.

The crude-fiber content of the hay is equally as important as the dry matter. Experience indicates that there is nearly a 25 per cent variation in the energy content of alfalfa hay as indicated by differences in the crude-fiber content. Of course, there are other important points, some of which can be judged by visual inspection; the chemical test will serve to supplement these observations.

A chemical analysis is of no use unless the sample analyzed truly represents the hay being considered. A hay sampler is available at most Farm Advisor offices and should be used on a minimum of 19 bales from a single lot of hay. A "lot" of hay is defined as one cutting of hay from the same field. The samples collected must be kept in airtight cartons so the moisture content will not change from that of the hay. Your Farm Advisor can provide a list of laboratories equipped to perform the modified crude-fiber laboratory tests.

The dry-matter results may be valid for only a few days since the moisture content of hay shifts rapidly with changes in weather. Crude fiber, however, is valid for a long time but needs to be recalculated on an adjusted dry-matter basis if the moisture content shifts. To convert to a 90 per cent dry-matter basis, use the following conversion factors:

If the laboratory reports show	Multiply crude fiber by:
Per cent D.M.	
80	1.13
82	1.10
84	1.07
86	1.04
88	1.02

Prevent contamination of milk from pesticide residues

It is illegal to sell milk containing foreign substances which include residues resulting from feeding contaminated feeds, the use of pesticides on the animals, or residues resulting from the use of antibiotics. The tolerance for these materials in milk is ZERO. Insecticide contamination of milk is most likely to come from feeds (primarily roughage), and from pest control measures. Animals exposed to certain pesticides in their feed or water, or through skin absorption, may store these materials in their body fat or other tissues. Some of these chemicals (chlorinated hydrocarbons such as DDT) are cumulative—the amount stored in the animals can increase with repeated exposures.

Research work done to date indicates that when such chemicals are stored in an animal's body, they are released into the milk even after the animal is no longer exposed to or receiving insecticides in her feed. This makes the problem more serious because it could take from several weeks to several months for the milk to become free of these residues if they are stored in large amounts in the cow's body.

Select feeds carefully

Do not feed vegetable by-products such as sweet corn, pea vines, or lima bean vines unless you are certain they are free from pesticides which can appear as a residue in milk. Sweet corn is particularly risky because DDT is used frequently in large amounts for the control of corn earworm. Silage made from these crops is as hazardous as the fresh forage.

The feeding of vegetable packing-house trimmings is also risky because a wide variety of insecticides is used in the pro-

When you know the crude-fiber content at the 90 per cent dry-matter level, the following table will give you the energy content and comparative value of the hay at various market prices. Also included are comparative values of silage, fresh green feed and irrigated pasture. This knowledge of relative costs and feeding value will enable you to plan a forage program which will provide adequate amounts of high-quality feed at low cost.

HOW TO JUDGE WHICH FEED IS A GOOD BUY

Alfalfa hay, 90 per cent D.M.			Comparative value, if market value of average alfalfa is			
Quality	Crude fiber content	Net energy	$20 per ton	$25 per ton	$30 per ton	$35 per ton
	per cent	*mcal/cwt*				
Excellent	Less than 21	47.4	$22.90	$28.62	$34.35	$40.07
Good	22–24	44.3	21.40	26.75	32.10	37.45
Average	25–27	41.4	20.00	25.00	30.00	35.00
Fair	28–30	39.0	18.84	23.55	28.26	32.97
Poor	31 or more	35.2	17.00	21.26	25.51	29.76
Silage, value per ton			6.67	8.33	10.00	11.67
Fresh green chop, value per ton			5.26	6.58	7.89	9.21
Irrgiated pasture, value per AUM			8.00	10.00	12.00	14.00

To determine which feed is the best buy, use the following procedure: If the market value of good hay is $30.00 per ton, hay of excellent quality is a good buy if it can be purchased for less than $34.35. On the other hand, green chop must be delivered to the cows for less than $7.89 per ton before it can be considered the more economical feed.

duction of fresh vegetables, many of which will accumulate in the fat of the animals and be secreted in the milk.

Watch alfalfa seed or clover seed threshings very carefully—as chlorinated hydrocarbon insecticides are widely used in commercial production of these seed crops.

Be careful of fruit by-products such as almond hulls and apple pulp or pomace—these and other fruits are usually treated with insecticides during the growing season.

Do not use DDT or similar insecticides on forage that is to be pastured or fed. Ordinarily, phosphate insecticides of short residual nature such as parathion, malathion, Systox, Dylox, Phosdrin and others are used for insect control on hay crops; however, Sevin and Methoxychlor can be used on forage crops providing the directions for use are followed.

Even though DDT and other chlorinated hydrocarbon insecticides are not applied to alfalfa in California, contamination of this crop may result from drift of these chemicals into alfalfa when neighboring crops are being treated.

When in doubt whether your hay is contaminated, arrange for tests to determine the amount and kind of insecticide present.

Be sure the sample tested is representative of your entire lot of hay.

For further information regarding approved materials for use around the dairy or on feeds and how to use them, consult your Farm Advisor.

THE REPLACEMENT HEIFER-RAISING ENTERPRISE

Most dairymen prefer to raise their own replacement heifers from calves they have selected from their better cows. They feel they can improve their herd faster in this manner than by buying cows of less dependable productive capacity. Hence they may be willing to raise replacements at a higher cost per head than that for which they could be purchased. Heifers can be raised more cheaply in natural pasture for part of each year in areas where forage costs are lower. Some dairymen rent pasturage for their growing heifers off the farm, or put them out to be raised on other farms at a head-month or pound-of-gain basis. But supply and demand determine current prices of springer heifers or cows for replacement purposes—not costs of growing them.

The heifer raising, considered as a separate enterprise, would cover all costs of raising replacements from the newly dropped calf to the springer ready to drop her first calf. Consideration of heifer raising as a separate enterprise requires records or estimates of the feed, labor, and other items separately from those for the milking herd. The heifer calves selected to be raised would be charged to the heifer enterprise at a farm value at that time and credited to the milking herd. When mature and transferred to the milking herd, each would be charged to the milking herd and credited to the heifer-raising enterprise at current farm values. Current values have recently been around $30 for heifer calves of good breeding and $275 to $300 for the two- to two-and-a-half-year-old heifer ready to freshen. The value of the heifers raised provides the income to this enterprise. Costs of the calves, feed, labor, and miscellaneous items are deducted to learn whether the heifer-raising enterprise is conducted at a profit or a loss. Over a year's time, there will be many new calves

The table on page 41 lists the cost of raising Holstein heifers from calves worth $30 apiece through two years under conditions of the San Joaquin Valley. It is based on a study by farm advisors in the San Joaquin Valley for 1961:

HOW MUCH IT COSTS TO RAISE DAIRY HEIFERS
(San Joaquin Valley, 1961)

Cost items by age periods	Cost per heifer
	Dollars
0 to 2 months: Weight 90 to 148 lbs	
Milk substitute 60 days except first 3; 45 lbs at 16 cents/lb	7.20
Calf concentrate 10 lbs first month and 70 lbs second month, 80 lbs at $3.75 cwt	3.00
Alfalfa hay, 75 lbs at $25 a ton	.94
Total feed cost to 2 months	11.14
Original cost or value of calf	30.00
Labor	5.50
Veterinarian and veterinary supplies	3.00
Bedding	1.50
Buildings, pens and equipment	1.50
Death loss at 5 per cent	2.35
Miscellaneous, including interest (43 cents)	2.00
Total cost to 2 months	56.99
2 to 6 months: Weight 148 to 355 lbs	
Calf concentrate: 400 lbs at $3.75 cwt	15.00
Hay: 600 lbs at $25 a ton	7.50
Total feed cost 2 to 6 months	22.50
Labor	3.30
Bedding	1.00
Miscellaneous, including interest ($1.40)	3.50
Total cost 2 to 6 months	30.30
Accumulated total cost to 6 months	87.29
6 to 12 months: Weight 355 to 632 lbs	
Concentrates: 450 lbs at $60 per ton	13.50
Hay: 2,160 lbs at $25 per ton	27.00
Total feed cost 6 to 12 months	40.50
Labor	5.00
Miscellaneous, including interest ($3.30)	6.40
Total cost 6 to 12 months	51.90
Accumulated total cost to 12 months	139.19
12 to 24 months: Weight 632 to 1,069 lbs	
Hay and other forage, 4 tons of hay equivalent at $22	88.00
Labor, figured on some pasturing	6.60
Breeding	7.00
Miscellaneous, taxes, etc	6.00
Interest at 6 per cent	11.58
Total cost 12 to 24 months	119.18
Accumulated total cost to 24 months	258.37

The list shows that it costs $258.37 to raise a heifer calf through 24 months under the conditions that prevailed in the San Joaquin Valley in 1961. The feeding schedule is based largely on hay as the main forage, and on the assumption that pasture would cost almost as much as hay for an equivalent amount of feed. Many Holstein heifers are not ready to freshen at two years of age, so a few months at $10 a month would bring total cost for a 28-month heifer to about $300.

entering the enterprise and springer heifers leaving, with animals of all ages being fed and cared for continuously. Costs per springer raised can be obtained by dividing total costs in the enterprise for a year by the number sold and transferred out during the year.

There are a few farms in California that have no commercial milking herd as such, but specialize in raising dairy

The table below presents a sample budget for an enterprise that would turn out 38 springers at the age of 28 months annually—enough to provide replacements for the 150-cow milking herd whose sample budget is given on page 14. The costs of heifer raising are based on the feed and labor use shown by periods on page 41, with a period added from 24 to 28 months, and lower-cost irrigated pasture substituted for half the hay used to grow the heifers.

In the budget listed below, it is assumed that 46 calves would be started each year, four would die, and four unpromising animals would be sold, to provide the 38 head of 28-month-old heifers needed. Death loss is covered by dropping animals, so is not shown as a cost.

HOW MUCH DOES IT COST TO RAISE 38 SPRINGERS AS REPLACEMENTS FOR A 150-HEAD MILKING HERD?

Age period through which each heifer passes	0 to 2 months	2 to 6 months	6 months to 1 year	1 to 2 years	2 years to 28 months	Total enterprise	Cost per heifer "cut"
Months in period	2	4	6	12	4		
Number entering each period annually	46	44	42	40	39		
Usual number on hand at all times	44 under one year			40	13	97	
Cost items	*Dollars*						
Inputs and costs							
Milk substitute 2,000 lbs at 16 cents	320					320	8.42
Calf concentrates 10.4T at $75	134	646				780	20.53
Concentrates 9T at $60			540			540	14.21
Alfalfa hay, 37T at $24 per T	41	317	530			888	23.37
Other forage-Hay equiv. 110T at $24				1,896	744	2,640	69.47
Irrigated and other pasture 382 AUM at $7.50			420	1.490	580	2.490	65.53
Total feed cost	495	963	1,490	3,386	1,324	7,658	201.53
Value of calves in, 46 at $30 per head	1,380					1,380	36.31
Labor 475 hrs (1.3 per day) at $2.00	250	140	210	260	90	950	25.00
Miscellaneous costs, taxes, medicines, etc.						380	10.00
Breeding fees 40 at $7.00				280		280	7.37
Depreciation calf barn and equipment						143	3.76
Interest on investment at 6 per cent, table page 41						712	18.74
Total all costs						11,503	302.71
Less heifers culled and sold—4 total	30	40	80		200	350	9.21
Net cost 28 mo. heifers raised						11,153	293.50
Value of heifers transferred out 38 at $300						11,400	300.00
Management income or true profit						247	6.50

The annual costs cover the 97 head of the ages shown in line 3 above. Each heifer turned out as a springer remained in this enterprise 2⅓ years. Net cost was almost $300 per springer raised.

heifers for dairymen in the congested corral dairy area. They may buy the calves and sell back the springers when ready to freshen or take calves in to raise for a charge per time period or pound of gain. This dairy-stock-raising enterprise is usually in an area where lower-cost forage is available from natural range and other forages. No sample budgets for such an enterprise are available. Profit factors, however, would be high efficiency in the form of good growth from available low-cost feeds and a good margin between calf costs and selling prices of springers or a good fee for raising the heifers.

FORAGE-CROP ENTERPRISES

Many California dairy farmers produce part or all of the forage needed by the milking herd and heifers raised on the farm. This forage is properly charged to the dairy at farm value—what it would bring if sold on the farm. Hence, it is usually of lower cost to the dairy enterprise than feed purchased and transported from neighboring or distant farms. Where feed can be raised at a profit when credited to the feed-crop enterprises at farm value, dairying can be more profitable on farm-grown feed than on purchased feed. The dairy enterprises get forage at less than it would cost if bought, and the feed-crop enterprises get as much for the feed grown as it would bring if sold. Transportation and dealing margins are avoided. This dairying on farm-grown forage, however, is limited to areas where forage-crop growing can be profitable, where costs are not too high as a result of competition for land and water with higher-value field, vegetable and fruit crops or other land uses such as in metropolitan fringe areas.

There are, however, many large areas in California where—because of soil, climate, or distance from markets—forage crops are one of the more profitable land uses. There are also large farms in areas where higher-income crops are grown but where it is still considered good farm management to include alfalfa and irrigated pasture in the rotation to maintain good soil condition and productivity. Hence, dairy-feed crops are grown in many areas. Feeds have been discussed in detail in a previous section. Sample schedules of inputs and costs in detail of these feed crops are obtainable from the farm advisors in many of the counties where they are grown. See page 46 for summary schedules for some of these feeds.

A variety of forage crops are usable by dairy enterprises, so in any area there are some available for a particular dairy farm. In nonirrigated areas with good seasonal rainfall, oat and vetch hay, dry-farmed silage, and improved or natural pasture are available. On shallow hardpan soils with irrigation available, irrigated pasture is a suitable forage crop. On good deep soils with adequate irrigation water, alfalfa, irrigated pasture and corn silage are usually raised on dairy farms, with some use made of a variety of other crops and crop residues.

Alfalfa is the main dairy forage crop in California. It is widely grown in our warmer irrigated valleys to be used locally and transported to dairies in other areas as baled hay. It is more largely used as hay but is also field chopped and fed green, pastured, and, in rare cases, made into silage. In foggy areas on the coast, where curing hay is difficult, it may be entirely fed as green chop. Alfalfa does, however, require a fairly deep soil and adequate irrigation for good yields of 6 to 10 tons per acre annually in five or six cuttings.

An alfalfa enterprise on a dairy farm may be on a smaller scale than on large field-crop farms where newer self-

propelled machines for swathing, baling, and hauling are justified. Knowing your production cost will tell you whether it is more economical to buy than to grow your own hay. Costs shown on page 46 are computed for the size and equipment used on a dairy farm of around 200 acres or less, so equipment use was not to capacity and resulted in higher overhead costs of depreciation and interest on investment. Costs shown for hay and green chop are about the same for equivalent feed value. A single alfalfa enterprise could provide both as needed.

Several crops may be grown for silage. Oats, or oats and vetch, may be grown as a winter crop and ensiloed in the spring. Then a summer crop of corn or sorghum can be grown on the same land and ensiloed in the fall. Each crop would be a separate enterprise and share the costs of land used. Yield per acre of the second crop, however, is usually less than that of a single crop planted earlier in the spring. The costs shown for corn silage on page 46 are for a single crop. The silo for storage is considered part of the milking-herd investment and is shown on page 53. Silage-enterprise costs end with harvesting, packing and covering the silage in the silo. Storing and feeding are dairy-enterprise costs.

Irrigated pasture has its use problems on a large dairy farm and usually costs more as a feed than is generally recognized in prevailing farm values of pasturage and rents. The cost comparison on page 46 shows two sets of production costs—one for the better crop lands of higher land values and taxes, and the other for the poorer shallower soils where irrigated pasture does not have to compete with more profitable crops. Although costs are $8.60 and $7.50 per AUM respectively, such feed is still cheaper than harvested forages. Although irrigated-pasture enterprises show little profit as compared to other forages, they do, through cheaper feed, make dairying more profitable.

Large commercial dairy farms need to know costs, returns and profits in their forage-crop enterprises. This requires enterprise accounting discussed on page 59. A summary of enterprise statements for a 150-cow, 182-acre dairy farm is shown on page 60.

PLANNING THE DAIRY-FARM BUSINESS

Profitable farming requires a balance among all factors of production: land, improvements and equipment, labor, livestock, operating capital, and management. A surplus or deficiency of one factor reduces potential earnings. Maximum profit in dairying requires that the number of cows be optimum for the production facilities, the forage produced, the workers supported the year around and within the managerial capacity of the operator. The owner-operator, through analysis of his business and its component enterprises, has the opportunity to discover changes that offer a good chance of improving profit. Forward planning can then be done to make these changes and achieve a larger net income. Alternative plans can be budgeted as to probable income, costs and profit, and the best plan selected. A good business with sound forward plans and budgets will find it easier to obtain the additional capital and credit required.

SIZE OF HERD

The number of cows should be enough to utilize the dairy labor available to comfortable capacity. In increasing the size of herd it may be necessary to do so in steps to fit the number of milkers needed—one man 75 cows, two men 150, and three men 225 cows. Milking-barn capacities, whether walk-through or con-

ventional stanchion barns with multiple turn-ins, are no longer much of a limitation to a moderate increase in number of cows milked if space and milking-machine units are adequate for the number of men working. Only a large increase in herd size might require new buildings for milking, shelter, and feed storage. Herd size will largely depend on forage production of a farm where most of the forage must be produced on the farm, as in the case of a manufacturing-milk herd. The adjustment of herd size to a Grade-A-milk marketing contract was discussed on page 21. Small sizes of herds fall into several natural sized groups described below.

Minimum sized side line

A small milking herd on a general farm is almost a thing of the past in these times of specialization. A herd of 10 cows is about the smallest that could justify a milking machine and place to milk. Only where a small farmer had some feed and free time that could not otherwise be sold or gainfully employed and he could properly care for the milk and sell it in cans, would such an enterprise be feasible. Even then, returns to labor and feed would be below those in commercial herd sizes.

The one-man dairy farm

A specialized dairy farm for the support of a single family with one worker would need to be from 30 to 80 cows. Where both pasture and hay are produced and the operator would do most of the farming and all the dairy work, around 30 to 50 cows would be all he could handle. Even so, he would be handicapped by too small a business to justify the farming equipment needed, and might have to custom hire some work such as making hay. He would be very busy all the year round. He would seldom have an opportunity to sell market milk. The 50-cow 75-acre example in the tables on pages 15, 48, 51, and 54 is of this size. Many of our manufacturing-milk dairies in the San Joaquin and Sacramento valleys and in Humboldt County are in this size group. A corral dairy of this size is rare, but with no forage production could be up to 80 cows.

The two-family dairy farm

A farm justifying the full-time services of two men can usually earn more than twice the profit from a one-man farm and is less confining. The nature of the work practically requires two men for some jobs and one can relieve the other in illness, vacations and days off. Forage production would be on a large enough scale so minimum equipment for hay and silage harvesting could be owned, and employment of outside seasonal labor avoided. One man could do the milking with a bucket-type milking machine for 60 to 80 cows, or with a pipeline milker for up to 100 cows. The other man could do the field work and assist and substitute in the dairy. The milker could also assist in field work.

A dairy farm of this size is large enough to obtain and hold a Grade-A contract, or would have a better net-income potential even as a manufacturing-milk dairy than the above one-man farm. The two-family dairy should provide a living for the two workers and their families. The two workers can be partners, a father and son, or an owner-operator and hired man. This size is suggested as the minimum goal for all dairy farmers. It is big enough to provide an overlap of father and son and for an easy transfer of the farm as a going concern from one generation to the next.

Larger farms

A larger size than the two-man farm offers cost-saving opportunities through fuller use of larger-scale dairy and crop equipment. It also offers an opportunity for the employment of more capital and managerial ability.

The 150-cow 180-acre dairy farm illus-

Every feed crop is best considered a separate enterprise conducted for profit. To be profitable it must be well adapted to the soil, climate, and water supply of your farm. The table below will help you decide what ofrage crop among those you are considering may be most profitable.

COST COMPARISON OF FORAGE CROPS

Yield, cost	Nonirrigated		Low-cost irrigated pasture	Good irrigated valley land			
	Natural pasture	Oat and vetch hay		Irrigated pasture	Alfalfa		Corn silage
					Baled hay	Green chop	
Yield, tons per acre of main crop		3.0			7.0	30	22*
AUM of pasture	2.0	.6	12.0	14.0	1.0	1.0	
	Dollars						
Costs per acre							
Cultural labor and field power	.60	15.00	18.00	20.00	22.00	22.00	41.00
Harvesting labor and field power		10.00			27.60	41.20	35.00
Total labor and field power†	.60	25.00	18.00	20.00	49.60	63.20	76.00
Irrigation water and power			8.00	12.50	11.25	11.25	7.50
Fertilizer, seed, sprays, wire and miscellaneous	.50	14.00	8.00	10.00	19.00	12.00	24.00
Total labor and material cost	1.10	39.00	34.00	42.50	79.85	86.45	107.50
General expense, insurance, repairs	.40	3.00	3.00	4.00	8.00	9.00	10.00
County taxes, land and equipment	1.00	2.00	5.00	8.00	8.00	8.00	8.00
Total cash costs	2.50	44.00	42.00	54.50	95.85	103.45	125.50
Depreciation:—On stand, alf. and ir. past			8.00	8.00	12.00	12.00	
Buildings, fences, irrigation system	.40	2.00	7.00	9.00	9.00	9.00	9.00
Tillage, harvesting and misc. equipment	.20	5.00	1.50	1.80	5.00	4.00	10.00
Tractors and trucks	.50	4.00	1.50	2.00	6.00	6.00	6.00
Total depreciation	1.10	11.00	18.00	20.80	32.00	31.00	25.00
Interest on investment—stand			1.50	1.50	1.00	1.00	
Buildings, fences, irrigation system	.25	1.50	3.00	5.80	5.80	5.80	5.80
Tillage, harvesting and misc. equipment	.10	4.00	1.00	1.10	3.85	2.90	4.40
Tractors and trucks	.25	2.00	.50	1.00	3.00	3.00	3.00
Land	3.60	9.00	24.00	36.00	36.00	36.00	36.00
Total interest on investment at 6 per cent	4.20	16.50	30.00	45.40	49.65	48.70	49.20
Total costs of production	*7.80*	*71.50*	*90.00*	*120.70*	*177.50*	*183.15*	*199.70*
Less value of pasture		2.50			8.60	8.60	
Net cost of main crop		*69.00*	*90.00*	*120.70*	*168.90*	*174.55*	*199.70*
Cost per ton or AUM of forage	*3.90*	*23.00*	*7.50*	*8.60*	*24.10*	*5.80*	*9.08*
Cost per 100 megacalories of net energy	*1.22*	*2.88*	*2.35*	*2.70*	*3.00*	*3.10*	*3.15*

* Silage yield and costs are based on 12 per cent loss or 22 tons fed from 25 tons put in silo. Cost of silo is not included but cost of a cover is.

† Labor and field power costs were computed at the following hourly rates: man labor $1.40, 30-h.p. tractor $1.10, 40-h.p. tractor $1.40, 2 T truck $2, baler and chopper engines $1.00—cash costs only.

trated in tables on pages 14, 53, and 60 is a typical size being attained by many successful Grade-A dairymen. It gainfully employs four men the year around—the operator who devotes most of his time to management but performs some labor, two milkers, and one farm hand. Extra help or contract work would be needed in silo filling. Most of the economies of larger-scale operations are attainable in this size of business. Milking herds of this size and larger are usually corral fed with harvested forage—hay, green chop, and silage. Pasturing becomes less convenient because of distance, lanes and fences, and the time needed for driving cows to and from the pasture. The 24-acre irrigated pasture shown for our sample farm on page 60 is only for the heifer-raising enterprise.

In herd sizes beyond approximately 150 cows, additional economies are not large. Managerial problems increase with greater dependence on hired labor and sometimes hired management. As herds become larger, most of the economies of farm-produced forage are lost with the increased dependence on purchased forage. There are, however, many herds with more than 300 cows. Some of these are on very large farms where most of the forage is produced along with field and vegetable crops. Many of the corral dairies in the metropolitan fringe areas around Los Angeles are quite large—up to 1,500 cows.

FORAGE BALANCE

Where dairy farms must depend largely on farm-grown forage to feed the herd, the balance between feed produced and needed becomes very important. Successful dairymen naturally tend to enlarge their herds and face the problems of buying additional forage or enlarging farming operations through buying or renting additional land. Several steps or alternatives are available. First, hay produced can be replaced by purchased hay and thereby production of green chop, silage and pasturage can be increased. Next the use of pasture by the milking herd is reduced or discontinued, with more green chop and silage produced for corral feeding. Finally, pasture may be entirely eliminated, with heifers grazed elsewhere. Even silage and green chop is sometimes purchased. But an adequate supply of high-quality forage at reasonable costs is so important to profit in the milking herd that careful planning of forage production and purchases is essential. Manufacturing milk dairies because of the low price received for milk cannot stand the cost of much purchased forage.

THE CROPPING PLAN

The first step in planning the forage supply is to make a forage crop plan to fit the land available. List fields by acreage, and select the best adapted forage crops for each. Grow natural pasture on nontillable land, and hay, silage, and improved or irrigated permanent pasture on the better fields, proportioned to about fit the herd need for feed of each type. Estimate yields per acre in tons of crop and AUM of pasturage, multiply by field acreages, and add the resulting total production to obtain the forage capacity of your farm. Figure the optimum requirement for each forage type for the milking herd and heifer raising, and compare the two total quantities. Adjust crop acreages or number of cows to obtain the desired balance.

To illustrate this procedure, a forage plan for 73 acres of irrigated land on which alfalfa and irrigated pasture are feasible is shown on page 48.

Plan for maximum pasture

Pasture is usually the cheapest dairy feed, as shown in tables on pages 29 and 46. It saves the cost of harvesting, storing and feeding in corrals. But pasture cannot be stored and is not available in even quality or quantity throughout the year. Generally, its quality and quantity is high in spring, but there is little available by

late fall, and almost nothing during the winter. Careful planning and the use of several kinds of pasture can, however, extend the season of pasture use somewhat. Better cultural care in fertilization and irrigation coupled with better grazing management can considerably improve irrigated-pasture yields. The daily ration system or strip grazing of irrigated pasture increases feed production and at the same time maintains more uniform production from day to day in milking herds.

The table on page 49 shows the AUM of pasturage normally obtainable by months for several crops and areas. Production will, of course, vary considerably in many areas from that shown because of climate or weather, soils and cultural care. Use of growing pasturage may be deferred a short time for later use. Winter grazing of alfalfa fields, irrigated pastures, barley and other fields is usually limited to periods when the soil is dry enough. A spring surplus of pasturage is usual but can be reduced by making a cutting of hay in enough fields to balance production to that needed. Natural pasture in the coast counties produces excellent pasturage usable by the milking herd for about four months, from March to June. The natural dry feed after that time may also be used, if properly supplemented, for dry stock and heifers, with resulting lower feed costs than if these animals were corral fed with harvested forage.

How much pasture?

Pasture is seldom expected to serve as the sole forage for a milking herd even in the spring when it is in surplus. High-producing cows may not be able to consume enough for maximum milk production, so are usually given a little hay as well as the concentrates fed at milking time. Analysis of feed inputs has shown large cows to take as much as 1.2 AUM of pasturage per month, but this is unusual. For management purposes, we sug-

To check if available land will produce enough forage for your herd, make your own forage plan. Here is an example:

FORAGE PLAN FOR 73 ACRES OF IRRIGATED LAND
(Will it satisfy the needs of a 50-cow milking herd?)

Field No.	Crop or land use	Acres	Yield per acre		Total production		
			Hay tons	Pasture AUM	Hay tons	Pasture AUM	Tons hay equivalent
1	Alfalfa, 1st year	10	5.0	1.0	50	10	54.0
2	Alfalfa, 2nd year	9	7.0	1.0	63	9	66.6
3	Alfalfa, 4th year	8	6.0	1.0	48	8	51.2
4	Irrigation Pasture, 1st year	9	1.0	8.0	9	72	37.8
5	Irrigation Pasture, 3rd year	10		12.0		120	48.0
6	Irrigation Pasture, 5th year	11		13.0		143	57.2
7	Irrigation Pasture, 6th year	8		12.0		96	38.4
8	Irrigation Pasture, 9th year	6		10.0		60	24.0
9	Calf Pasture, 10th year	2		12.0		24	9.6
	Total production	73			170	542	386.8
Need for year							
For 50-cow milking herd, table, page 15					135	400	295.0
For heifer raising—14 26-month heifers per year					25	127	75.8
Total need					160	527	370.8
Difference					10	15	16.0

The result shows a comfortable surplus to meet feed needs—advisable to cover waste or poorer yields.

How much pasturage can you expect? The table below gives you amounts, in AUM, normally available throughout the year in various areas and from various crops:

ANNUAL PRODUCTION OF VARIOUS PASTURES

Crop	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
	AUM												
Irrigated permanent pasture, southern California	.6	1.0	1.5	1.7	1.8	1.4	1.4	1.2	1.3	1.4	1.1	.6	15.0
Irrigated permanent pasture, Central Valley	.1	.4	.8	1.2	2.0	1.8	1.6	1.3	1.2	.8	.6	.2	12.0
Barley for winter pasture	.5	.6	.7	1.0	.2	...	...	...	...	...	...	..	3.0
Barley for grain, summer is stubble	.4	...	...	...	...	...	.4	.4	...	...	...	..	1.2
Natural range, average	..	.1	.2	.3	.1	.1	...	...	...	...	...	..	1.0
Good range near coast	.1	.2	.3	.4	.5	.3	.1	.1	...	...	...	..	2.0
Sudangrass, irrigated	..	...	...	...	...	1.0	1.5	2.0	1.0	.5	...	..	6.0
Sudangrass, nonirrigated	..	...	...	...	.5	1.0	.7	.4	.3	.1	...	..	3.0
Reasonable need per cow and young stock	.5	1.0	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.0	.8	.6	13.0

A herd in which adequate replacements are being raised will contain from 1.35 to 1.5 animal units per cow and can use around 1.3 AUM of pasturage per cow each month. Since it is impossible to obtain much pasture in winter, 13 AUM of pasture per cow is the maximum usable.

gest figuring on 1 AUM per milking cow per month, with the balance of the cow's feed furnished from hay and concentrates. The heifer-raising enterprise would call for another third of an AUM for each cow in the herd. Hence we show on page 49 a need of 1.3 AUM per month per cow. Recognizing the lower level of pasture available in the winter, an annual maximum is about 13 AUM per cow for both the milking herd and heifer-raising enterprises. If more than enough heifers to maintain the herd were being raised, this could be 1.5 AUM per cow monthly or 15 AUM per year where irrigated pasture is the main source of pasturage.

In a nonirrigated or natural pasture area, total use of pasturage by cows in milk is about 4 AUM, and a little more during a dry period. This, plus about 3 or 4 AUM for young stock, comes to a total of 8 or 9 AUM per cow. In some areas along the North Coast, this might be a little higher. Where less is available, harvested forage can make up the deficit. Some dairymen, with inadequate pasture for the milking herd, still pasture their cows for a short period once a day.

Making a pasture plan

A pasture plan lists the fields and crops that can be pastured and shows the months when pasturage is available and can be taken for best results. You would ordinarily start with the land and crops as in a cropping plan, and figure the total pasturage obtainable in AUM each month. This would show how many cows could obtain an optimum quantity of pasture at 13 AUM per cow with irrigation, or 9 with natural grazing. Or a start could be made to plan maximum usual pasture for a given number of cows. In this case, pasture crops would take priority over harvested crops such as hay which could be purchased. The table on page 51 illustrates such a pasture plan using the fields and crops shown on page 48. The small surpluses or shortages by months show a reasonably good fit of production to optimum needs. If it were desirable to have more pasturage for a small increase in milking herd, additional fields of pasture could replace alfalfa-hay production. If the entire 73 acres were in irrigated pasture, a herd of 73 cows plus the usual young stock could receive about optimum pasture. Hay would be purchased from off the farm.

Every change in size of herd, acres of land farmed, forage crops grown requires a different plan. These plans should be made in advance and budgets prepared to forecast probable changes in costs, income and profit.

STARTING A NEW DAIRY-FARM BUSINESS

Starting a new dairy-farm business—the buying or renting of a farm, the buying of equipment and cows—requires a considerable capital outlay. Careful planning is essential to success. The investment necessary, including overhead and living costs during the development period before income begins, must be foreseen and provided for.

Most experienced or potential dairymen with adequate capital normally prefer to buy a farm and have the facilities they want. This gives them a wider choice of suitable places. With limited capital, however, renting offers a better opportunity to operate a business of adequate size to make a living and get ahead financially.

MARKET FOR MILK

The first consideration in establishing a dairy-farm business is an assured outlet for the milk. A manufacturing-milk dairy would need to be within a pickup route of one or more creameries or manufacturing plants or within a reasonable hauling or shipping distance to a plant receiving milk in cans. A new market-milk dairy

To know in advance during what months pasture is available and how much you need to supplement your supply, you can make up a pasture plan. The plan below shows the pasturage available on the 73-acre farm assumed on page 48 for the 50-cow dairy herd for which income was calculated on page 15.

SAMPLE PASTURE PLAN FOR A 73-ACRE, 50-COW DAIRY FARM

Field No.	Crop or land use	Acres	Pasture available												Total
			Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
			AUM												
1	Alfalfa, 1st year	10	..	..	..	..	..	..	..	..	..	..	10	..	10
2	Alfalfa, 2nd year	9	..	..	..	..	..	..	..	..	..	..	..	9	9
3	Alfalfa, 4th year	8	..	..	..	..	..	..	..	..	..	8	(plow)	..	8
4	Irrig. pasture, 1st year	9	..	..	..	..	6	13	12	11	12	10	7	1	72
5	Irrig. pasture, 3rd year	10	1	4	10	12	15	15	12	12	13	11	9	6	120
6	Irrig. pasture, 5th year	11	2	6	12	14	17	16	15	14	16	13	10	8	143
7	Irrig. pasture, 6th year	8	1	3	6	10	14	13	11	10	11	9	5	3	96
8	Irrig. pasture, 9th year	6	1	1	4	6	8	8	7	6	7	6	4	2	60
9	Calf pasture, 10th year	2	..	1	2	2	3	3	3	2	3	2	2	1	24
	Total pasture obtainable	73	5	15	34	44	63	68	60	55	62	59	47	30	542
Need for 50-cow milking herd			..	..	..	30	50	50	50	50	50	50	50	20	400
For calves and heifers			8	16	16	16	16	16	16	16	16	16	16	8	176
Total desirable			8	16	16	46	66	66	66	66	66	66	66	28	576
Difference—surplus or shortage			−3	−1	18	− 2	−3	2	−6	−11	−4	−7	−19	2	−34

Results show a reasonably good fit. Surpluses can be used the following month and the small shortages can be covered by feeding hay. The surplus in March could be used by pasturing the cows then, or a field could be cut for hay.

would need a contract with a distributor to assure a market for the milk. New contracts are extremely difficult to obtain in most areas in California, so it is usually necessary to buy an established herd and have the contract or shipping rights transferred to the new owner.

SIZE OF BUSINESS

The next step in organizing a new farm business is to decide on the size of herd to start with and perhaps an ultimate goal allowing for some growth. It is a mistake to start too small, particularly with a heavy debt, with only a hope of making a living, paying off debts, and then increasing the size of the business to make a more adequate income. As you begin to search for a suitable place and learn about purchase costs or rentals, the available capital plus the probable credit obtainable will somewhat determine the size of herd that you can safely finance.

INVESTMENT REQUIRED

The capital investment required is determined by the size and type of dairy farm. The tables on pages 53 and 54 present sample investments for a 150-cow, Grade-A, and a 50-cow, manufacturing-milk dairy complete with all facilities and land and equipment for forage production. These tables, drawn up for two assumed situations, can be used as a guide in preparing similar schedules for the specific farm you are considering, and after you know the local land values and prices of buildings and equipment. You will have to make, of course, the appropriate changes and adjustments. You will have to figure an investment schedule for the size of farm under consideration, for the number of cows, for the buildings, equipment, and other items needed. A dwelling will be needed in addition to the items shown in the sample schedule. Buildings on an existing farm would have to be checked for adequacy, condition, and cost of rehabilitation to suitable condition. The time and cost of making the move, getting the buildings and equipment ready, assembling a herd and getting into operation may add considerably to the investment shown or expected, and must be allowed for. In the case of new construction, unforeseen costs and changes are probable.

A renter moving his herd from another farm must also estimate the new capital required by the move and perhaps to enlarge his herd and add new equipment.

Before closing any purchase or lease, determine the investment or capital required and make certain that it is within your capital and credit limitations. Draw up a budget to show that the net income potential is adequate to furnish a living and to make the required payments on debts.

MAKING A BUDGET

A budget is an estimate made in advance of expected production, prices, income, costs, and net income. Making such forecasts of production, yields, prices and costs is not easy; but it can be done intelligently enough to forecast a chance of success or failure. A budget can be prepared only after a plan is adopted for a particular farm. With several farms and plans under consideration, prepare budgets for each plan on the same price and other assumptions to show which plan is the most profitable. In this manner you can choose the most profitable alternative and prevent the serious mistake of going ahead on a plan doomed to failure.

CREDIT

The dairy business is stable, with a regular monthly cash income that does not fluctuate very much. Credit is available to the good dairymen for most sound purposes. Long-term credit for buying and enlarging dairy farms is available up to a considerable percentage of the appraised value of the real estate mortgaged to secure the loan from national farm-loan associations, insurance companies, banks, and individuals. Shorter-term credit is

If you intend to buy a market-milk dairy, this sample investment will help you figure the investment needed for the farm you are considering. Adjust this sample to your particular situation:

WHAT INVESTMENT IS NEEDED FOR A 150-COW MARKET-MILK DAIRY?

Investment	Original cost (1961 prices)	Life expectancy	Annual depreciation*	Average value†	Per cow
	Dollars	*Years*	*Dollars*		
Milking Herd Enterprise					
Land in dairy buildings and lots, 5 acres	3,000	..	.....	3,000	20.00
Milking barn and milk house 8-stall	10,000	25	392	5,100	
Feed and shelter barns and miscellaneous buildings	12,000	25	472	6,100	
Fences, feed bunks, water troughs	3,000	20	150	1,500	
Paving, 7,000 sq ft	2,400	25	96	1,200	
Bunker silo, 700-T capacity	4,000	25	160	2,000	
Water and liquid waste disposal systems	3,000	20	140	1,550	
Employees cottages, two	8,000	30	260	4,100	
Total, buildings and improvements	42,400	..	1,670	21,550	143.67
Milking machine, pipeline 6-units	6,000	20	285	3,150	
Milk tank and refrigeration 1,000 gal	5,400	20	255	2,850	
Miscellaneous other dairy equipment	2,500	10	250	1,250	
Half investment—feed wagon, tractor, and loader	3,200	12	250	1,700	
Total, equipment	17,100		1,040	8,950	59.67
150 cows, $300 cost, average value $225	45,000			33,750	225.00
Usual feed and supplies on hand	4,650			4,650	31.00
Total, milking-herd enterprise	112,150		2,710	71,900	479.34
Heifer-Raising Enterprise					
Land for barn and pens, ½ acre	300		...	300	
Calf barn, sheds and equipment	3,000	20	143	1,575	
Heifers, average 100 head all ages	10,000			10,000	
Total, heifer-raising enterprise	13,300		143	11,875	79.16
Total, milking-herd and heifer-raising enterprises	125,450		2,853	83,775	558.50
Forage Enterprises					
Land, 174-acre crops, 2 other	105,600		...	105,600	
Irrigation system, buildings, fences	35,200	20	1,624	17,610	
Tillage and harvesting equipment	12,600	15	820	6,450	
Tractor, pickup and truck	10,800	15	680	6,000	
Half cost, feed wagon, tractor, loader	3,200	12	250	1,700	
Total, forage enterprises	167,400		3,374	137,360	915.74
Total dairy-farm investment	292,850		6,227	221,135	1,474.24

* Calculated with salvage value, if appropriate, by the straight-line method for the years of life shown.
† Depreciable items estimated at an average of original cost and salvage value.

This sample shows that, at 1961 prices, with land assumed to cost $600 per acre (which is low for many areas), the total investment for a 150-cow market-milk dairy, not including operator's dwelling, would be $292,850.

If you are considering a manufacturing-milk dairy, this sample investment will help you figure investment needed for the farm you have in mind. Adjust the sample to your particular situation.

WHAT INVESTMENT IS NEEDED FOR 50-COW MANUFACTURING-MILK DAIRY?

Investment	Original cost	Life expectancy	Annual depreciation	Average value	Per cow
	Dollars	*Years*	*Dollars*		
Milking Herd Enterprise					
Land in dairy buildings and lots 1 acre	400		...	400	8.00
Milking barn and milk house 8-stall	2,000	20	95	1,050	
Feed and shelter barns and other buildings	2,000	20	95	1,050	
Corral fences, feed bunks, etc.	500	20	25	250	
Water system—dairy share	500	20	24	260	
Total, buildings and improvements	5,000		239	2,610	52.20
Milking machine, bucket type 3 units	900	15	50	525	
Milk cooling and holding tank, 500 gal	3,250	20	150	1,750	
Other dairy equipment	300	10	30	150	
Total, dairy equipment	4,450		230	2,425	48.50
Cows 50, average value $200	13,750		...	10,000	200.00
Average feed and supplies on hand	2,000			2,000	40.00
Total, milking herd	25,600		469	17,435	348.70
Heifer-Raising Enterprise					
Land .2 acre	80		...	80	
Calf barn, pens, equipment	1,000	20	45	550	
Stock on hand 29 average at $90	2,610	..	...	2,610	
Total investment, heifer enterprise	3,690		45	3,240	64.80
Total, milking-herd and heifer-raising enterprises	29,290		514	20,675	413.50
Forage Production Enterprises					
Land, 72-acre crops, 1 other	29,200		...	29,200	
Irrigation system	9,000	20	435	4,650	
Buildings, fences, etc.	2,700	20	115	1,350	
Farming equipment	5,600	15	342	2,955	
Tractor and pickup	5,600	15	360	2,900	
Total, forage enterprises	52,100		1,252	41,055	821.10
Total dairy farm investment	81,390		1,766	61,730	1,234.60

This sample shows a minimum investment of $81,390 (not including operator's dwelling) for a 50-cow dairy in an area of low land values of $400 an acre.

available from commercial banks, loan associations, individuals and dealers for purchase of cows and equipment which become chattel mortgage collateral to secure the loan. Additional operating credit may be obtainable for volume purchases of feed where the financial status of the borrower and a forward budget show it will enable him to improve his income and repay the loan. The potential borrower receives from credit organizations some safeguards against borrowing too much. But, it is also the borrower's responsibility to safeguard himself by the budget test discussed above. He must be reasonably sure he can live and make the payments required. It is well to reserve some additional borrowing capacity to care for unpredictable financial setbacks and accidents. Certainly the dairy farmer with adequate records who makes forward plans and budgets improves his chances of success and also the ease with which he can obtain needed credit.

RENTING

Many California dairy farms are rented. The landlord usually furnishes land, buildings, irrigation facilities, and some nonmovable equipment. The tenant usually furnishes cows, movable equipment, and labor.

It is generally accepted that, in renting, the income should be divided between landlord and tenant in proportion to their contributions, or what they furnish and the costs they pay. The landlord's contribution is largely the use of his capital invested in land and buildings. This is converted into an annual charge by figuring interest at an appropriate rate (usually 5 or 6 per cent) on the current valuation. Depreciation on the facilities furnished by each party may be readily estimated; so can the labor and management furnished by the tenant. Other costs can be determined from past records, or may be estimated from available local information. The amount contributed by each party may then be totaled to show their costs. A "Work Sheet for Estimating Rent or Shares" is available from your Farm Advisor.

To illustrate this process of calculating the division of costs between a landlord and tenant, an example of the usual division for the 75-acre, 50-cow manufacturing-milk dairy is shown on page 56. Costs are divided for the entire farm business—the milking herd, the heifer-raising enterprise, and forage production. Obtaining or estimating these costs will not be easy for a new undertaking since a former tenant may not be available or willing to furnish his costs for a previous year. It is usually best for landlord and tenant to get together and fill out this work sheet, perhaps with some help from a local Farm Advisor who may have enterprise data sheets to supply some of the costs needed.

FORMS OF RENT

Rent can usually be paid in one of three forms: cash, share, or quantity of product.

Cash rent

A fixed annual or monthly cash rent, agreed upon in advance for the period of the lease, is probably the commonest form of dairy-farm rental in California. If set fairly and recognized as an average for changing price-and-production conditions over a period of years in which the tenant carries most of the risk, it is a simple, satisfactory method. It sometimes breaks down in years of low price or low production on the farm when the tenant finds it impossible to pay the rent. Cash rent should be a little lower than rent paid under a more flexible system where the landlord shares in production and price fluctuations.

Cash rents may also be varied with the price of milk. This is sometimes called the sliding-scale cash rent. Provision is made in the lease for the rent to change when a specified official price quotation has changed. Particularly in long-term leases, this would adjust the rent to retain a fair

If you plan to rent a dairy farm, this sample will help you calculate a fair division of costs between landlord and tenant. Adjust it to your particular situation.

SAMPLE FOR A 75-ACRE, 50-COW MANUFACTURING-MILK DAIRY FARM

Investment, cost, income	Furnished by: Tenant	Furnished by: Landlord	Total farm business
		Dollars	
Capital invested (page 54)			
Land, 75 acres, at $400		30,000	30,000
Farm buildings, fences, irrigation system		9,240	9,240
Dwelling		5,000	5,000
Dairy equipment	2,425		2,425
Farming equipment	5,855		5,855
Dairy stock and feed on hand	20,045		20,045
Total investment	28,325	44,240	72,565
Depreciation			
Farm buildings, fences, irrigation system		789	789
Dwelling		250	250
Dairy equipment	230		230
Farming equipment	702		702
Total depreciation	932	1,039	1,971
Cash costs			
Hired labor	340		340
Concentrates bought	3,400		3,400
County taxes	400	630	1,030
Insurance	30	60	90
Dairy supplies, breeding, electricity, etc.	1,250	....	1,250
Repairs—improvements and equipment	200	150	350
Irrigation district tax and water charge		750	750
Tractor and pickup operating costs	700		700
Machine rent and contract work	240		240
Fertilizers, seed and crop supplies	500		500
Subtotal cash costs	7,060	1,590	8,650
Labor and management	4,800	100	4,900
Depreciation, from above	932	1,039	1,971
Interest on investment at 6 per cent	1,700	2,654	4,354
Total all costs	14,492	5,383	19,875
Less stock sales, all to tenant	1,825		1,825
Net cost of milk sold	12,667	5,383	18,050
Per cent each party	*70.2*	*29.8*	*100.0*
Sample rent at 125 cwt of milk a month			
Milk sales, 5,000 cwt at $3.30	11,500	4,950	16,500
Stock sales	1,825		1,825
Income	13,375	4,950	18,325
Net income over total costs above	−1,117	−433	−1,550
Net income over all costs but interest	583	2,221	2,804
Net farm income over all costs but labor and management	5,383	2,321	7,704

In this case (page 56) the tenant incurred about 70 per cent of the total net cost of the milk produced, and the landlord 30 per cent. This does not mean they should agree on a share rent with the landlord receiving 30 per cent of the value of the milk sold. But this information, made to fit the circumstances of each case, will help you find the amount or form of rent fair to both parties. In some cases, the landlord may furnish the cows and all equipment, and both parties would split the income 50–50 from both milk and young stock raised. If the calculation in the particular case shows that such a division would not be fair, some expenses could be split differently to maintain the fairness of the 50 per cent split of income.

division of the earning power of the total dairy-farm business.

Share rent

Rent as a specified share of the milk income would, on first thought, seem fairer than cash rent, since it divides the risk of price and production variations. On dairies which are largely dependent upon rainfall for farm hay and pasture production, there are wide differences in feed production and in the cost of hay that must be bought. Where the farm furnishes the forage, one-third of the milk is a common share rent; this may go up to one-half where the landlord furnishes the cattle and perhaps pays part of certain costs.

The drawback to a straight share rent where the tenant owns the cattle is that the landlord, without making any contribution, shares in the additional income from high production, heavier feeding, and better management. And he suffers when management is poor, when the animals are underfed, and the farm is understocked. For share renting to be fair to the tenant, the landlord should share in the purchased feed costs, perhaps in the same proportion that he shares in the value of milk produced.

In the sample on page 56, the landlord furnishes about 30 per cent of the net costs of the milk produced and would, therefore, be entitled to 30 per cent of the milk. Yet, the tenant stands all the costs of obtaining high production, such as furnishing superior cows and paying for all the concentrates. If the landlord paid for 50 per cent of the concentrates, it would raise his share to 39 per cent. Shifts of certain expenditures from one to the other can adjust the share to some desirable common level, such as one-third or one-half. It is not usual for the landlord to share the stock raised, where the tenant owns the stock.

Quantity of product

Another but less common form of rent, prevalent in Humboldt County, is the rent based on the value of a certain quantity of milk. The farm is rated according to its capacity for a certain number of cows, and cows are assumed to have a certain standard of production. This is the rated capacity of the farm in milk. A certain proportion of this capacity, usually about one-third, is considered the annual rent, and is paid monthly or in eleven monthly installments at the price of milk for that month omitting a winter month when most cows are dry.

Under this system, it matters little to the landlord whether his tenant has high- or low-producing cows. If the tenant buys extra feed and has high production per cow or carries more cows, he does not have to share the extra income with the landlord. This system permits the rent to vary with variations in price of product, but not with variations in production due either to management or to climatic conditions. The plan is probably the most satisfactory to both tenant and landlord in a region where feed production on the farm varies little from year to year. But the rating of the farm and the determin-

ing of the quantity of milk to be paid as rent must be fair to both.

In the example on page 56, where about 30 per cent of the milk produced was found to be a fair rent, the total milk sale was expected to be 5,000 cwt for the year. The farm produced enough forage for that quantity of milk, and the landlord should expect any good tenant to obtain this total production. Thirty per cent of that quantity is 1,500 cwt a year—a fair standing rent. It would be 125 cwt a month. This would be a simple rent to administer. They could instruct the creamery to pay the landlord each month for 125 cwt of milk at the current price for that month. Hence, both parties would share in the variations in income due to price fluctuations, but the tenant would stand all the variations in production up and down, which are admittedly due to his management.

Profit sharing

Among other special arrangements of paying rent are partnerships and profit-sharing agreements—a division of gross or net income on the basis of the inputs of each party. In some cases, a wage or bonus is given to a foreman or herdsman in terms of income or profit. In a few instances, the milkers or barn crew have been paid from 12 to 20 per cent of the milk check. Where workers are paid in this manner, they may be tempted to overfeed concentrates if they are not supervised carefully or made to pay an equivalent share of the concentrate cost.

A calculation similar to that on page 56 is useful in arriving at actual shares, or at an agreement for the future. If gross income is shared, the person receiving that share should also share in some of the costs necessary to obtain high production.

DAIRY-FARM RECORDS

In these days of intensive and highly specialized commercial farming with narrow margins between income and costs, it is becoming increasingly difficult to make a profit. Good records are needed on the farm business as a whole for reporting income, costs and net income, and capital gains or losses for federal and state income tax returns. Additional special records are required for Social Security and disability-insurance deductions for employees. Other records and business papers are required in obtaining refunds of gasoline taxes on the gasoline used within the farm. But, even more and better records are needed for management purposes—to discover changes that can be made and to furnish valid information for the many administrative decisions that must be made.

To obtain high and efficient production, the dairyman needs production records on each individual cow for guidance in culling, breeding, and feeding concentrates. These are obtainable for a small monthly charge per cow from the local Dairy Herd Improvement Association. Breeding records are needed to insure that cows and heifers are bred when necessary to obtain proper lactation periods and avoid unnecessarily long dry periods. Feed use should be available to check against probable needs to assure adequate feeding without overfeeding—particularly of higher-cost concentrates. Feed bills should be added and the quantity checked to current optimum practices to avoid wasteful overfeeding. Milk-sales statements should be kept and analyzed as to prices received frequently, and the percentage paid for at Class-I prices for market milk should be determined.

Annual inventories of stock and feed on hand are essential to figuring a true profit for farm operation for each year, even though not used if income-tax reporting is on the "cash basis." Stock on hand by age groups should be known to

More detailed information on the subject of farm accounting and management records can be obtained in these three publications:

Manual 31, *Farm Enterprise Accounting and Management*, $1.00.
Explains enterprise accounting by the two principal methods. Illustrations of forms, records, work sheets.

Circular 460, *Financial Records for California Farmers*, free.
Explains record needs in general. Will help you select the best way to obtain records and needed information.

The California Farm Record Book, $1.00.
Records of cash incomes and expenditures by kind, capital and depreciation records, inventories, net-worth statements and profit statements on both the cash and inventory basis for income-tax and management purposes.

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check on feed use and costs. Feed on hand must be known to figure total feed use and check against probable feed requirements and for planning an economical feed supply for the future. A capital and depreciation record is essential to figuring depreciation correctly and to show current remaining values of all assets. These facilitate the preparation of accurate net-worth or financial statements to know whether and how fast you are getting ahead financially.

Dairy farmers who keep their own records will find that the California Farm Record Book (see box) will meet most of their record needs.

Larger dairy-farm businesses may need a full accounting system involving commercial bookkeeping methods. Such an accounting system, with its many ledger accounts on the farm business as a whole, plus certain supplemental records, is the minimum needed by an individual with large complicated business affairs. It is also essential where more than one family is involved in the ownership and profits of the farm business.

ENTERPRISE ACCOUNTING

This is a system of accounting that supplements accounting for the farm business as a whole by providing a profit statement and cost analysis for each crop and livestock enterprise in the farm business. These statements furnish valuable management information leading to a more profitable selection and balance of enterprises. The analysis of each enterprise indicates changes to make it more profitable. Management of a large dairy farm would be greatly helped with detailed input and cost information on the milking herd, the heifer-raising enterprise, and each forage crop. Enterprise statements, as shown in the samples on pages 14, 15, 42, and 46, would be made for comparison from year to year and to published standards or sample-cost schedules. Page 60 presents a sample summary of the enterprises on a 180-acre dairy farm.

Enterprise accounting requires the allocation of all farm costs and income to the individual enterprises. Labor costs are allocated by time cards and a payroll record, which distributes the labor cost to enterprise columns. Farm-machinery costs are handled through a farm-machinery service unit by charging work done for enterprises at appropriate hourly rates. Other costs are allocated on some appropriate basis monthly or at the end of the year by work sheets or supplementary enterprise cost sheets or accounts. Records of farm-grown forage are used to charge

it to the milking herd and heifer-raising enterprises and credit it to the crop enterprises at farm value.

There are two main methods of doing enterprise accounting. The first is by work sheets with allocations usually completed at the end of the year. This method is best suited to the farmer who keeps his own records as in the California Farm Record Book and makes his own allocations and statements. The other method is by a supplementary ledger of enterprise and service unit accounts in a full accounting system on the farm business as a whole. In this method, accounts are generally brought up to date at the end of each month. Both methods would require labor and farm-machinery records and

Enterprise accounting provides profit statements and cost analyses for each enterprise on your farm and enables you to make profitable shifts and changes. Adjust sample below to your particular situation.

WHERE IS YOUR PROFIT?
SAMPLE ENTERPRISE ACCOUNTING FOR A 180-ACRE, 150-COW IRRIGATED DAIRY FARM

Income, expense, profit	Alfalfa 120 acres	Irrigated pasture 24 acres	Corn silage 30 acres	Total forage enterprises 174 acres	Heifer raising 100 head	Milking herd 150-cow Grade A	Total farm business cash basis
				Dollars			
Income							
Milk sold						88,124	88,124
Dairy cattle sold					250	6,315	6,565
Dairy cattle transferred					11,400	1,380	......
Alfalfa hay @ $24	13,272			13,272			
Alfalfa green chop @ $6	6,750			6,750			
Corn silage @ $9			6,588	6,588			
Irrigated pasture @ $8.50		2,822		2,822			
Manure hauled to fields						600	
Total income and credits	20,022	2,822	6,588	29,432	11,650	96,419	94,689
Dairy cattle transferred					1,380	11,400	......
Farm forage charged					6,527	22,905	......
Concentrates bought					1,640	11,700	13,340
Hired labor	2,800	347	970	4,117	450	12,000	16,567
Operating costs, tractors, trucks	2,551	40	1,005	3,596	30	450	4,076
Electric power	1,350	300	225	1,875	12	420	2,307
Fertilizer, seed, crop expenses	1,400	144	570	2,114	......	......	2,114
Manure to crops	200	100	300	600	......	......	......
Repairs, miscellaneous, general expenses	1,032	96	321	1,449	100	2,370	3,919
County taxes	960	192	240	1,392	125	1,080	2,597
Dairy supplies, vet, etc	......	......	......	......	293	4,695	4,988
Depreciation (including stands)	3,800	499	750	5,049	143	2,710	7,902
Subtotal	14,093	1,718	4,381	20,192	10,700	69,730	57,810
Operator's labor and mgt. $7,200	1,534	156	410	2,100	600	4,500	7,200
Total expense	15,627	1,874	4,791	22,292	11,300	74,230	65,010
Net profit or capital income	*4,395*	*948*	*1,797*	*7,140*	*350*	*22,189*	*29,679*
Total investment	*98,667*	*18,168*	*24,600*	*141,435*	*11,875*	*71,900*	*225,210*
Rate earned on investment (per cent)	4.5	5.2	7.3	5.1	2.9	30.9	13.2

records of crop harvesting, pasture use, irrigation-water use, fertilizer hauled out, etc.

This more valuable accounting for management purposes requires additional work by the farm staff and bookkeeper, and costs more in most cases. The more precise administration and management made possible usually improves net income enough to more than pay the cost. For any farm for which enterprise accounting is desired, there are ways of doing or hiring it at a reasonable cost.

In order that the information in our publications may be more intelligible, it is sometimes necessary to use trade names of products and equipment rather than complicated descriptive or chemical identifications. In so doing, it is unavoidable in some cases that similar products which are on the market under other trade names may not be cited. No endorsement of named products is intended nor is criticism implied of similar products which are not mentioned.

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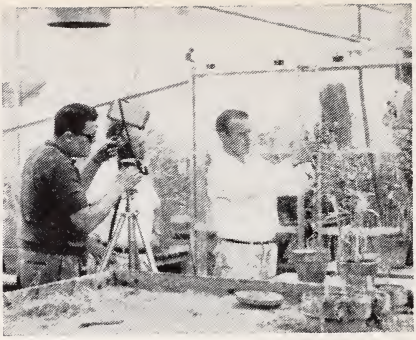

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